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On all editorial matters, please contact: Neil A. Harriman, Editor, Biology Department, University of Wisconsin-Oshkosh, Oshkosh, WI 54901; 920. 424. 1002 (office); or at 5188 Bittersweet Lane, Oshkosh, WI 54901; 920. 233. 1973 (home); harriman@uwosh.edu – please use e-mail whenever possible.

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THE RARE PLANTS OF FORT MCCOY MILITARY RESERVATION, MONROE COUNTY, WISCONSIN

Mark K. Leach

The Nature Conservancy, Wisconsin Field Office
333 West Mifflin Street
Madison, Wisconsin 53703

ABSTRACT

Fort McCoy Military Reservation is a 24,180 ha United States Army training facility in west-central Wisconsin. In 1991 and 1992 I conducted the first extensive survey at the fort for rare vascular plants, documenting 89 stations of 14 species including four Wisconsin threatened and 10 Wisconsin watch-list species. Two species, bog bluegrass (*Poa paludigena*) and fame flower (*Talinum rugospermum*), were also listed as United States Fish and Wildlife Service Category 2; large populations of these grow at the fort. One formerly documented species, the Wisconsin endangered rough white lettuce (*Prenanthes aspera*), was apparently extirpated. I briefly describe my observations on population size, habitat and apparent threats. For convenience of reporting, the rare plants are discussed in an upland group (*Artemisia dracunculus*, *Asclepias ovalifolia*, *Gentiana flavida*, *Opuntia fragilis*, *Polytaenia nuttallii*, *Solidago sciaphila*, and *Talinum rugospermum*) and a lowland (or wetland) group (*Bartonia virginica*, *Carex folliculata*, *Poa paludigena*, *Polygala cruciata*, *Rhexia virginica*, *Scleria triglomerata*, and *Thelypteris simulata*). Generally, rare plant conservation appears to be compatible with military training: both benefit from restoring and maintaining semi-open, savanna-like upland landscapes and preventing activities which would damage wetlands.

INTRODUCTION

Fort McCoy Military Reservation is an installation of the United States Army located in Monroe County, Wisconsin (Figure 1). The primary mission of the Fort is to serve as a facility for military training. Training first began on Major General Robert Bruce McCoy's ranch in 1905. The army bought 5,750 ha in 1909 and has since used the facility more or less constantly. Currently more than 100,000 people train there annually. The fort now occupies 24,180 ha, of which 23,358 ha are classified as "unimproved."

The facility lies south of the Tension Zone (Curtis 1959) within the Driftless Area (Figure 1), an unglaciated region of geologically ancient, highly eroded, steep-sloped, sandstone hills with narrow ridges and broad valleys. Prior to Euro-American settlement, the generally thin upland soils supported vegetation described by Hole & Germain (1994) as "largely oak savanna, with patches of oak forest. Some white pine (*Pinus strobus*) and red pine (*P. resinosa*) were present on favorable exposures and on coarse-textured soils. The savanna was composed of bur, white, black, and Hill's oaks (*Quercus macrocarpa*, *Q. alba*, *Q. velutina*, and *Q. ellipsoidalis*) in a matrix of prairie grasses and forbs." The



FIGURE 1. Fort McCoy Military Reservation (black) is located in Monroe County, Wisconsin within the Driftless Area (dotted lines), west of the ancient bed of Glacial Lake Wisconsin (gray), and south of the Tension Zone (dashed lines; Curtis 1959). The size of the fort averages about 25 km north to south and 8 to 10 km east to west, Latitude $43^{\circ} 54'$ to $44^{\circ} 9'$ North, Longitude $90^{\circ} 36'$ to $90^{\circ} 46'$ West.

nutrient-poor drought-prone soil, the short growing season, and common wild fires combine to maintain much of the savanna-like character of the uplands. However, many areas now are presumably more densely timbered than at settlement.

Some of the valleys contain extensive wetlands on soils varying from sand to muck. Existing wetland communities include hardwood swamp, wet prairie,

sedge meadow, *Sphagnum* bog, shrub-carr, tamarack (*Larix laricina*) swamp, and emergent aquatic marsh. The fort contains 10 major and 10 tributary streams, totaling 17.7 km in length. They are cold, fast-flowing, spring-fed, and sandy-bottomed. Trainers restrict military equipment, for the most part, from wetlands and streams.

Annual normal precipitation is 79 cm (Fort McCoy 1983). The Mauston weather station, which is about 48 km east-southeast of Fort McCoy, reports 84 cm of mean average annual precipitation, with most falling in summer (30 cm). They also report that the area has an average summer temperature of 20° C and average winter temperature of -8° C, with extremes of 39° C to -38° C. Median last and first frost dates are May 15 and September 26. The year-to-year variation of weather parameters is considerable. Like many other military installations, Fort McCoy has preserved rare species and communities, including what is likely the largest metapopulation of the federally endangered Karner blue butterfly (*Lycaeides melissa samuelis*; Leach 1993a, Bleser 1993). Other rare animals found at the fort include the phlox moth (*Shinia indiana*; Maxwell & Ferge 1994, Kirk 1994) and the slender glass lizard (*Ophisaurus attenuatus*; Nedrelo 1994).

Fort McCoy's Natural Resource Management Division (NRMD) contracted with The Nature Conservancy-Wisconsin Field Office to survey the fort for rare plants. During the growing seasons of 1991 and 1992 I surveyed for populations of vascular plants listed by the Wisconsin Department of Natural Resources as Endangered, Threatened, or Watch and plants listed by the United States Fish and Wildlife Service as "Category Two." State and federal agencies are considering "Watch" and "Category Two" species, respectively, for protection as Threatened or Endangered. No plant species currently listed as federally endangered or threatened were thought to occur on the fort. Here I give a condensed and revised version of my rare plant survey report (Leach 1993b). I conclude this paper by discussing the challenges for continued plant conservation in the midst of a heavily used military training facility.

METHODS

Within the boundaries of Fort McCoy, I conducted status surveys for rare plant species. Fourteen such species had previously been reported as growing on the fort. I resurveyed their historic locations (if known) as well as other likely habitats. I worked full-time throughout most of the growing season in 1991 and 1992, alternating this survey with surveys for the Karner blue butterfly (Leach 1993a) and its host plant, wild lupine (*Lupinus perennis*). I surveyed most portions of the fort except the "hot" North Impact Area—a 2100-ha target area for live ammunition. For each population encountered I mapped the location and recorded the population size, extent, habitat, associated species, and possible threats.

The names of tentatively identified specimens were verified by Theodore Cochrane, Curator, University of Wisconsin Herbarium, Madison and by other herbarium staff. Robert Freckmann, University of Wisconsin-Stevens Point, helped name numerous grass specimens. Nomenclature follows Gleason & Cronquist (1991).

RESULTS

I increased the number of known rare plant stations (Table 1) from 27 to 89. Of those populations, 48 were fame flower (*Talinum rugospermum*). I verified the presence of thirteen previously reported rare plant species and I documented one new species: dragon's sagewort (*Artemisia dracunculus*). I did not find five previously reported species: large water starwort (*Callitriche heterophylla*), tufted hairgrass (*Deschampsia cespitosa*), large-leaved avens (*Geum macrophyllum*), rough white lettuce (*Prenanthes aspera*), and silky willow (*Salix sericea*). Of these, only the record of rough white lettuce, which was made in 1981, was supported by a clearly identifiable specimen (Bever, WIS). Without good specimens, the other reports are questionable.

For convenience, the findings are presented in two groups: upland species and lowland species (Table 1). The upland species are geographically centered on the Great Plains or the Midwest and the lowland species are geographically related to eastern North America. Each species' summary includes a description of population size and habitat at the fort. Herbarium specimens that I collected or examined are indicated parenthetically.

I. Upland Species

The fort's extensive oak and jack-pine (*Pinus banksiana*) savannas, dry prairies, and sandstone outcrops supported seven rare plant species. Clearly, the most widespread and abundant of the rare plants at the fort was the fame flower (*Talinum rugospermum*: Portulacaceae). This small, fleshy-leafed, perennial herb grows in the upper Midwest, Nebraska, Kansas, and east Texas, but is most common in western and central Wisconsin (Cochrane 1993). I found populations in four previously reported locations and in 44 new locations. It subsequently has been found elsewhere on the fort (Dave Beckmann, pers. comm.; Maxwell & Givnish 1994).

At Fort McCoy, fame flower thrives in areas with apparent intermediate intensity disturbances (e.g., mechanical or fire) either in full sun or partial shade. It most commonly grows in small vegetation gaps (about 5 to 30 cm diameter) within a matrix of short native species, such as Pennsylvania sedge (*Carex pensylvanica*). This is consistent with Cochrane's (1993) view that fame flower is not a typical sand prairie species, but is a specialist with a narrow ecological amplitude and a lack of competitive ability. Habitats at the Fort were jack-pine barrens, sandy oak savannas, sand prairies, semi-eroded sandy slopes, sandstone outcrops, and the margins of sand blows and tank trails.

I found one population of dragon's sagewort (*Artemisia dracunculus*: Asteraceae). It is a herbaceous perennial native to Eurasia and the Great Plains. The eastern limit of its North American range is in Wisconsin. The Fort McCoy population included about 50 apparent clones, each with from five to 100 stems. These were located in full sun on a good quality bluff prairie situated on a steep (20–30 percent) southwest-facing slope (Leach 2319, WIS). This habitat is similar to the sandy bluff prairies (Mickelson & Iltis 1966) and rocky bluff prairies (Hartley 1966) described for other Wisconsin populations.

TABLE 1. Rare vascular plants found at Fort McCoy Military Reservation. Legal status is given as WI-W ("Watch" species in Wisconsin), WI-TH ("Threatened" in Wisconsin), and Cat-2 (United States Fish and Wildlife Service Federal "Category 2"). Species listed as "Watch" and "Category 2" were being considered for protection as Threatened or Endangered. The number of sites documented in this study for each species is given under "stations." An asterisk indicates species for which additional stations were discovered since 1992. Superscripts following common names indicate their phylogeographic affinities. Upland species are elements of (1) the Great Plains, (2) the Midwest and Appalachia, or are (3) endemics or near endemics to the Midwest. Wetland species are elements of (4) the Atlantic coastal plain, (5) the northeastern United States, or (6) much of the eastern United States.

Upland species grow in dry sandy and rocky places, primarily sand prairies, oak and jack-pine barrens, and rocky slopes.

	Status	Stations
Dragon's sagewort ¹ (<i>Artemisia dracunculus</i>)	WI-W	1
Oval milkweed ¹ (<i>Asclepias ovalifolia</i>)	WI-W	1*
Cream gentian ² (<i>Gentiana flavida</i>)	WI-TH	4
Brittle prickly-pear ¹ (<i>Opuntia fragilis</i>)	WI-TH	1*
Prairie parsley ¹ (<i>Polytaenia nuttallii</i>)	WI-TH	9
Cliff goldenrod ³ (<i>Solidago sciaphila</i>)	WI-W	1
Fame flower ³ (<i>Talinum rugospermum</i>)	WI-W, CAT-2	48*

Wetland species grow in moist sand, wet meadows, swamps, alder thickets, and along streams.

Screw-stem ⁴ (<i>Bartonia virginica</i>)	WI-W	1
Long sedge ⁶ (<i>Carex folliculata</i>)	WI-W	11
Bog bluegrass ⁵ (<i>Poa paludigena</i>)	WI-TH CAT-2	4
Cross milkwort ⁴ (<i>Polygala cruciata</i>)	WI-W	1
Meadow beauty ⁴ (<i>Rhexia virginica</i>)	WI-W	1
Tall nut rush ⁶ (<i>Scleria triglomerata</i>)	WI-W	1
Massachusetts fern ⁵ (<i>Thelypteris simulata</i>)	WI-W	5

Like dragon's sagewort, the prairie parsley (*Polytaenia nuttallii*: Umbelliferae), was associated with steep, rocky, southwesterly slopes (Leach 2238, 2239, 2281, WIS). Prairie parsley, as its name implies, is often described as a plant of prairies and plains (e.g., Gleason & Cronquist 1991), but sometimes also of open woods (e.g., Mohlenbrock 1975). At Fort McCoy prairie parsley grew in the partial shade of a black or Hill's oak canopy, where warm-season prairie grasses grew poorly, if at all (see Leach 1996, Leach & Givnish 1999). These slopes had not burned recently.

Prairie parsley can live several years as a basal rosette of leaves before putting up a flowering stalk, after which the plant dies (Hubner & Leach 1995). I found rosette-stage individuals scattered under the oak canopies, but flowering individuals were much more common in small light gaps. I found few individuals growing among the prairie grasses in the well-lit areas between trees. There the accumulated litter was much thicker than beneath the trees. Their exclusion from small patches of prairie is consistent with observations that short and basal-rosette plants are likely to be lost from Wisconsin prairie remnants in the ab-

sence of frequent fires (Leach & Givnish 1996). The fire frequency may have been low at these sites owing to the presence of nearby pine plantations, which are protected from fire.

Another species I found on rocky, shaded slopes was the cliff goldenrod (*Solidago sciaphila*: Asteraceae). This perennial herb is endemic (Salamun 1963) or nearly endemic (Nuzzo 1995) to the Driftless Area. It grows on cliffs, outcrops, talus slopes, and rarely in sandy oak or jack-pine savannas at the base of cliffs (Salamun 1963, Hartley 1966). I documented only one population of cliff goldenrod (Leach 2325 & 2326, WIS), where it grew on slopes, ridge tops, and outcrops with a semi-open canopy of black oak and jack pine. There the associated groundlayer vegetation was sparse and composed of low-growing plants including pussy toes (*Antennaria plantaginifolia*), Pennsylvania sedge, and Canada mayflower (*Maianthemum canadense*). I suspect cliff goldenrod is much more common than suggested by this single observation. The bulk of my survey work was in the summer and I lacked experience recognizing this fall-flowering species in its vegetative state.

Oval or dwarf milkweed (*Asclepias ovalifolia*: Asclepiadaceae) is an herbaceous perennial ranging from northern Illinois and Wisconsin to southern Saskatchewan and western South Dakota (Woodson 1954, Gleason & Cronquist 1991). At the fort, I could not relocate one historic population of oval milkweed reported to be within the Silver Creek State Natural Area. I thought the population had been extirpated owing to lack of fire and increased shading from young growth of white pine. However, after several years of observation, Judy Maxwell (pers. comm.) observed the reappearance of the milkweeds. In another historic site, Kristin Westad and I found what appeared to be a single clone. There the canopy of oaks allowed little direct sun. Since milkweeds are suspected of being self-incompatible (Woodson 1954), this isolated population is unlikely to reproduce sexually and, thus, is unlikely to survive in the long term.

In contrast to the fort's shaded population, this milkweed's habitat in Wisconsin is generally sunnier—sandy prairie and open woods (Hartley 1966, Woodson 1954, Noamesi & Iltis 1957). In a statewide survey, Westad (1994) reported a severe decline in oval milkweed. She found that populations survived where the tree canopy remained open. In 1997 Judziewicz (1997) discovered 15 new sites in Jackson County, which is immediately north of Fort McCoy (Figure 1).

The brittle prickly-pear (*Opuntia fragilis*: Cactaceae) is a small, spiny cactus found in sandy to rocky prairies and hillsides across the Great Plains (Barkley 1986). Its eastern range limit is in Wisconsin and northern Michigan. It is remarkable for its tolerance of extreme cold temperatures (Loik & Nobel 1993, Ishakawa & Gusta 1996). A large population, which I estimated to include more than 10,000 individuals, grew at Fort McCoy on a single, treeless, sandy, south-facing slope. This slope had been highly disturbed by horses and munitions-loading activities during the First World War. Where prickly-pear grew densely, many individual plants had more than 20 pads. These formed canopies with diameters between 15 and 36 cm. Among these larger plants were many small plants, which may have been seedlings or vegetative offspring. No one I spoke to who was familiar with this population could recall seeing any plants in bloom.

I found other individuals scattered up to 500 m away in both full sun and the partial shade of scrub oaks. These cacti were relatively small, suggesting their recent dispersal from the main population. As the common and scientific names suggest, pads readily break off the mother plant. Their many spines easily attach to boots or animals that readily carry the small pads. Subsequent to this study, Judy Maxwell (pers. comm.) discovered another population in a south-facing sandy oak barren.

Areas supporting brittle prickly-pear at the fort were rocky or sandy openings in oak-barrens. Little bluestem (*Schizachyrium scoparium*) was dominant and other grasses were common, including big bluestem (*Andropogon gerardii*) and fall witch-grass (*Leptoloma cognatum*). This habitat is similar to those described by Ugent (1962) for central and northwestern Wisconsin.

In a brief inspection of the fort's brittle prickly-pear population in 1998, I found the number of individuals was considerably less than observed in 1992. I also observed that the density of prairie grasses, sweet clover (*Melilotus* spp.), and leafy spurge (*Euphorbia esula*) had increased. The increased growth of prairie grasses may have decreased the growth of brittle prickly-pear in two ways: directly, by intercepting light and, indirectly, by mediating feeding by specialized insect herbivores (Burger & Louda 1994, 1995).

The cream gentian (*Gentiana flavida*: Gentianaceae) is an essentially Midwestern and Appalachian herbaceous perennial. On the fort, I found cream gentian in places that had once been highly disturbed. The two larger populations, each containing dozens of individuals, grew on sandy former farm fields that had been abandoned about 40 years previously. At the time of my survey, dry prairie species, most notably little bluestem, and agricultural weeds dominated. Two smaller populations, both in road rights-of-way, each consisted of a single plant. Mason & Iltis (1965) and Hartley (1966) describe cream gentian habitat as remnant prairie or edges of dry oak woodlands, not as disturbed ground. However, I found a large population in Lafayette County in southern Wisconsin, occupying an eroding road cut (Leach 1989).

II. Lowland Species

The fort's complex of streams, swamps, and wet meadows supported seven rare plant species (Table 1). The one I most commonly found was the long sedge (*Carex folliculata*: Cyperaceae). It occurs throughout much of the eastern United States, but in Wisconsin is restricted to four contiguous counties (Figure 1): Clark, Jackson, Monroe, and Juneau (Alverson & Iltis 1981). Hartley (1966) incorrectly placed the Wisconsin populations entirely within the old bed of Glacial Lake Wisconsin (Figure 1). I found this relatively tall sedge (to about 1 m) in four of five previously reported locations, including one described by Tans and Read (1975), and in seven new areas (Leach 1941, WIS). It most commonly grew among mossy hummocks in red maple (*Acer rubrum*) or tamarack swamps and on the margins of streams lined with speckled alder (*Alnus incana*), winterberry (*Ilex verticillata*), and poison sumac (*Toxicodendron vernix*). It was nearly always growing with cinnamon fern (*Osmunda cinnamomea*) and skunk cabbage (*Symplocarpus foetidus*). The number of individuals in these populations ranged

from dozens to tens of thousands. In portions of some tamarack swamps, long sedge was the dominant ground-layer plant. While populations occurred in both shaded and well-lit locations, the more open-grown plants were larger and bore fruit more often.

The Massachusetts fern (*Thelypteris simulata*: Aspleniaceae) is a medium-sized fern that is relatively common in swamps and moist woods from the eastern shore of Lake Huron to Nova Scotia and Virginia. Its disjunct occurrence in Wisconsin was unknown until 1958, when Hartley (1965) discovered it in the old lakebed of Glacial Lake Wisconsin (Figure 1). Hartley (1966) described it as locally abundant in low sphagnum woods with red maple, white pine, and white oak. In appearance it is similar to the common marsh fern (*Thelypteris palustris*), but the two do not hybridize (Tyron & Tyron 1973).

Massachusetts fern had been reportedly collected by Gage and Bever and had been seen by Dobberpuhl (1988). I found it in two of the three previously reported locations and in three new locations. The ferns were commonly elevated on mossy hummocks near streams, often in speckled alder thickets, tamarack swamps (Leach 1959, WIS), and less often in open bogs. In one red maple-white pine swamp it grew in wet sandy soil without moss.

Bog bluegrass (*Poa paludigena*: Poaceae) is a rarely collected small grass found in bogs and wet woods from New York and Pennsylvania to Wisconsin and Illinois (Gleason & Cronquist 1991). Fassett (1951) indicated only three locations in Wisconsin, in cool mossy springs. The bog contains large populations of bog bluegrass. I surveyed four populations along cool, sandy, fast-flowing streams (Leach 2280, 2282, 2286, 2287, WIS; Leach 2291, UWSP), including one previously known location (Bever 54, WIS; Dobberpuhl 1988). Some individuals grew on moist, moss-covered logs or on mossy beds along streams. Hundreds of bog bluegrass plants grew on moist, mossy terraces under partial shade with a lush herb layer. Common herbs included soft rush (*Juncus effusus*), sensitive fern (*Onoclea sensibilis*), tear-thumb (*Polygonum sagittatum*), and common vervain (*Verbena hastata*).

Where one stream was widened and braided above a dam, bog bluegrass grew in full sun in very shallow, slow moving water among small, scattered patches of sedges and marsh-marigold (*Caltha palustris*).

Another small, easily overlooked plant is screw-stem (*Bartonia virginica*: Gentianaceae). This annual (or biennial) has scale-like leaves and may be dependent upon mycorrhizal association. In Wisconsin, Mason & Iltis (1965) and Hartley (1966) describe it as growing in a variety of moist, wet, or boggy sites in shade or sun. I found no screw-stem in a previously reported location. However, Kristin Westad and I found screwstem (Leach & Westad 2311, WIS) in an area described to us by Robert Freckmann and James Hessil (pers. comm.). We counted about 30 individuals on bare, black soil in a moist woodland of white oak and red maple. The understory included scattered cinnamon fern, long-awned wood grass (*Brachyelytrum erectum*), bear sedge (*Carex arctata*), and star flower (*Trientalis borealis*).

Tall nut rush (*Scleria triglomerata*: Cyperaceae) occurs in moist sandy soil or marshes (Greene 1953) from Massachusetts to Wisconsin and south to Georgia

and Texas. In Wisconsin, it grows primarily on sand prairies (Alverson & Iltis 1981) and moist, sandy meadows (Hartley 1966).

A small population discovered at the fort by Eric Epstein contained about 25 fruiting stems (*Leach 1964*, WIS). These grew in a floristically rich area of moist, sandy soil located between a sedge meadow and upland oaks. Most plants grew in open places between aspens (*Populus tremuloides*) and paper birch (*Betula papyrifera*) or in areas kept clear of trees under an overhead transmission line. Immediate associates included upland and lowland species, including prairie heart-leaved aster (*Aster oolentangiensis*), flowering spurge (*Euphorbia corollata*), alum root (*Heuchera richardsonii*), cinnamon fern, royal fern (*Osmunda regalis*), and downy phlox (*Phlox pilosa*).

Cross milkwort (*Polygala cruciata*: Polygalaceae) is a small annual herb found chiefly on the Atlantic coastal plain (Gleason & Cronquist 1991) and is considered disjunct in Wisconsin (Reznicek 1994). At the fort, Eric Epstein and I discovered dozens of these herbs (*Leach & Epstein 1980a*, WIS) where sand had been mined down to the water table. Populations located on other excavations were reported in the Chicago region (Swink & Wilhelm 1994) and in Michigan (Harvey Ballard, pers. comm.). The Fort McCoy site was a more than 100-year-old sand borrow pit that remains moist throughout much of the growing season. The sunny, wet, low-nutrient conditions supported a large number of short plants including grass-pink (*Calopogon tuberosus*), round-leaved sundew (*Drosera rotundifolia*), club-spur orchid (*Habenaria clavellata*), bog clubmoss (*Lycopodium inundatum*), rose pogonia (*Pogonia ophioglossoides*), and yellow-eyed grass (*Xyris torta*).

Occurring near the cross milkwort was a population of meadow-beauty (*Rhexia virginica*: Melastomaceae), another disjunct from the Atlantic coastal plain (Reznicek 1994). In Wisconsin, this species mainly occurs in the ancient bed of Glacial Lake Wisconsin (Figure 1), in moist sedge meadows, sandy roadside and railroad ditches, and under jack pine along edges of bogs (Ugent 1962). Alverson & Iltis (1981) describe suitable habitats as wet, sandy flats and drying lake borders.

I found a single, dense colony (*Leach 1970*, WIS) where a communications cable was buried several years previously through an area of jack pine on moist sand. The immediate area had an uncommon flora, including colic-root (*Aletris farinosa*), grass-pink, and round-leaved sundew.

DISCUSSION

Fort McCoy is an important refuge for rare plants and animals. It contains, perhaps, the world's largest meta-populations of Karner blue butterflies (Bleser 1993, Leach 1993a), fame flower, and bog bluegrass. Its populations of long sedge, prairie parsley, brittle prickly-pear, and Massachusetts fern could be the largest in Wisconsin. In such a heavily used military training facility as Fort McCoy, these and the other smaller populations of rare plants could become extirpated without active management and protection.

In the past, the survival of rare plants at the fort was incidental to military activity. Although thousands of soldiers have trained there each year, the fort is so

large that many areas remain relatively unaffected. Rare plant survival was probably also aided by the combination of nutrient-poor, drought-prone soils and accidental wildfires that slowed forest succession, consumed plant litter, and inhibited alien invasions (Leach & Givnish 1996).

For the last several years, the fort's Natural Resource Management Division (NRMD) has taken an increasingly pro-active approach to rare species protection. The fort has placed three areas under the protection of the Wisconsin Natural Areas Program. In addition to my survey for rare plants, experts have surveyed for reptiles, amphibians, birds, small mammals, fish, moths, butterflies, and other invertebrates. Experimental control of pest species, including leafy spurge and reed canarygrass (*Phalaris arundinacea*), is underway. In 1994 the NRMD added a full-time, endangered-species biologist whose primary concern is meeting the legal requirements of the Endangered Species Act as they pertain to the Karner blue butterfly. This biologist also works to minimize impacts on all rare plant and animal populations. Importantly, military commanders, engineers, and trainers have cooperated with the NRMD to protect most rare species from the negative effects of heavy training. The exception is fame flower, which receives no specific protection. Fame flower appears to benefit from small-scale soil disturbances such as those caused by the occasional sod-busting action of track vehicles.

To perpetuate rare species, management must look beyond minimizing impacts and toward active management to increase the numbers and sizes of rare populations. One such action being undertaken by the NRMD, in consultation with U.S. Fish and Wildlife Service, is the development of ecosystem approaches to savanna management (Leach & Ross 1995, Leach & Givnish 1998) to ensure survival of the Karner blue butterfly. Ecosystem management for the Karner blue (Bleser & Leach 1994) could also benefit the upland rare plants found in the butterfly's habitat. Such management includes prescribed fire and selective timber harvests. The military trainers prefer savanna-like landscapes for their training activities and, therefore, are supportive of this ecosystem approach. However, construction and training facility "improvements" will continue to threaten potential rare plant habitat.

A survey for rare plants raises more questions than it answers. How under-reported were the easily overlooked species (i.e., cliff goldenrod, fame flower, screw stem, bog bluegrass, cross milkwort, and tall nut rush)? How should rare species be monitored? How does training affect rare species? How stable are their populations? Does military training on cliffs and rocky outcrops damage populations of cliff goldenrod in the same manner as have recreational rock climbers in Illinois (Nuzzo 1995)? Ideally, each species should have its own conservation plan based on the best scientific knowledge. In reality there are large gaps in our knowledge of the ecology and population biology of these species and too few resources devoted to writing and implementing such plans.

Fort McCoy is a laboratory well suited for research that addresses both practical problems faced by conservationists (e.g., habitat restoration) and theoretical questions yet unanswered by science. For more information on ongoing research and research opportunities at the fort, interested individuals should contact the endangered species biologist at 608. 388. 2252 or write Directorate of Public

Works, ATTN: AFRC-FM-PWN, 2160 South "J" Street, Fort McCoy, Wisconsin 54656-5162.

ACKNOWLEDGMENTS

The Nature Conservancy Wisconsin Field Office employed me for this study, under contract with Fort McCoy and with major support from the Department of Defense Legacy Program. I thank Nancy Braker of the Nature Conservancy and the NRMD staff at Fort McCoy: Kim Mello, Timothy Wilder, James Kerkman, James Hessil, David Beckmann, Candy Thornton, and Major (retired) Dennis Kuecherer. Thanks also to Gary Larsen of the U.S. Army Corps of Engineers. Ted Cochrane, Robert Kowal, Hugh Iltis, Harvey Ballard, and Robert Freckmann named or verified the identity of numerous specimens. Hugh Iltis, Harvey Ballard, Mike Penskar, and an anonymous reviewer offered useful criticisms of earlier versions of this work. Michelle Milbauer and David Egan helped edit the final manuscript. Michael Williams of the Center for Environmental Management of Military Lands, Colorado State University, provided the updated information found in the Addendum below.

Addendum: The Center for Environmental Management of Military Lands, Colorado State University, now maintains records of Fort McCoy's rare plants. Since my initial survey, they report verified collections of *Carex laevivaginata* (Wisconsin Endangered), *Orobancha uniflora* (Wisconsin Special Concern), and *Solidago caesia* (Wisconsin Endangered). They have also recorded additional populations of *Asclepias ovalifolia* (one population); *Bartonia virginica* (one population); *Scleria triglomerata* (one population), and *Talinum rugospermum* (several populations). The *Bartonia* and *Scleria* were found in the same habitat where I reported *Polygala cruciata*. I reported *Prenanthes aspera* to be likely extirpated, but eight individuals have subsequently been observed within about 3 km of the originally reported site.

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REVIEW

GRAND HAVEN WILDLIFE VIEWING GUIDE. 2001. Betty J. Mattson. Illustrations by Kelly Jewell. 102 pp. paperback; \$13.00 with tax and shipping; Sky Enterprises Publications, 805 Waverly Avenue, Grand Haven, Michigan 49417, with checks payable to Sky Enterprises.

The city of Grand Haven is on Lake Michigan, in Ottawa County in Michigan's Lower Peninsula. It offers many fine viewing sites.

"You should never judge a book by its cover." But in this instance, the cover is sketches of waterways, trees, and other plants, an accurate introduction to the contents, because this fine new book gives information about the plants and animals supported by these habitats.

By focusing only on Grand Haven's sites, Mattson was able to include details often omitted in more general guides. Tips on what wildlife to see, exactly where, at which season, and hints on how to for the creatures are presented from the author's perspective as an educator.

Separate sections for birds, other animals, and plants have alphabetical listings by common name, with Latin binomials following. For ease of use, simple codes for site, season, and status all appear in a single line. Her writing reflects dedication to details, which are amply supported by Kelly Jewell's line illustrations.

Historical backgrounds on the Kitchel-Lindquist Preserve, Harbor Island, and East Grand River Park expand our understanding of the area. The book is en-

riched by accounts such as one by Yvonne Way, whose great-grandfather started a bed of North American water-lotus (*Nelumbo lutea*) in the Grand River. Robert Riepma's remarks in his article about hybrid gulls gave me a good giggle. (Don't you agree, that one may as well laugh at gulls as cuss at them?)

Liberal credit for quotations and contributions appears, with many Michigan Botanical Club members included. As the author notes, "Luckily for me, people who really are knowledgeable are often willing to share their expertise." That seems to be particularly true for MBC folks. Nine pages of references indicate how much research went into the guide. Readers are asked to bring any errors to Mattson's attention, for an already-planned second edition.

The Grand Haven Wildlife Viewing Guide is small enough to slip into a pocket or backpack, but it is not a field guide, the author reminds us. Jewell's sketches, particularly those of the wood warblers, show excellent diagnostic markings, even without color. The device of placing all the woodpeckers on the same page assists quick comparison, although differences in sexes have not been noted.

The plant section of 14 pages appears last; the author's accomplishments with the White Pine Chapter of Michigan Botanical Club clearly indicate her awareness that plants are the basis of all life.

The Viewing Guide is attractive to both amateur and to advanced users, because it has the common names arranged alphabetically (with Latin binomials following), and they are grouped by type rather than strict taxonomic affinities. The cost of the book is less than the money one would spend on gasoline while engaged in futile searches.

—Joy Andrews
93756 Streeter Drive
Lawton, Michigan 49065

REDISCOVERY OF WOLFFIELLA GLADIATA (LEMNACEAE) IN INDIANA

Mitchell S. Alix & Robin W. Scribailo

Department of Biology
Purdue University North Central
Westville, IN 46391-9528
alix@purdue.edu

Wolffiella gladiata (Hegelm.) Hegelm. (synonyms: *Wolffiella gladiata* var. *floridana* Donn. Sm., *Wolffiella floridana* (Donn. Sm.) C. H. Thomps.), commonly referred to as the sword bogmat or mud-midget, is a warm-temperate species in the Lemnaceae. It has more of a southern to southeastern distribution in the United States where it is found in areas having humid growing seasons and mild winters (Gleason & Cronquist 1991; Landolt 1986; Landolt 2000). Throughout its range, the sword bogmat is found partially submersed and free-floating in sheltered stagnant waters of ponds, lakes, marshes, and sloughs. In the Great Lakes region, *W. gladiata* is quite rare (Landolt 1986) and it is the only one of three *Wolffiella* species found in the United States (Landolt 2000). In Indiana, it is known from only two historical populations (Deam 1940; Hicks 1937). Because of the age of the records for this species and the lack of confirmation on the continued persistence of these populations of *W. gladiata*, it is currently considered as being extirpated from the state (Indiana Natural Heritage Data Center 2000).

As one of the world's smallest flowering aquatic angiosperms (Fassett 1940; Hicks 1937; Sculthorpe 1967), plants of *W. gladiata* have no true roots, leaves, or stems, and like all other species in the Lemnaceae, the plant body is reduced to a simple thallus (frond). The thin, tongue-shaped thallus is approximately 3–9 mm in length and 0.3–0.8 mm wide and is often attached to other thalli, forming a small colony of plants, which in turn may become interwoven with additional colonies or with other free-floating species resulting in a mat (Landolt 1986; Landolt 2000). Although *W. gladiata* occasionally flowers, it rarely produces fruits (Landolt 1986; Landolt 2000). Reproduction most often occurs by means of vegetative budding (Gleason & Cronquist 1991; Hicks 1937).

During the first stage of our effort to document the aquatic flora of Indiana and map its many state-listed species, floristic surveys of over 110 lakes and ponds have been conducted in the northern and central part of the state from 1995 to 2000. In many cases, visits were made to sites having documented historical occurrences of imperiled species to determine if these populations still persist. During the course of this fieldwork, we have discovered five new locations for *W. gladiata* and rediscovered this species at one of the two sites of its historical occurrence (Fig. 1). Below is a chronological account of the events leading to the rediscovery and documentation of additional populations of *W. gladiata* in Indiana.

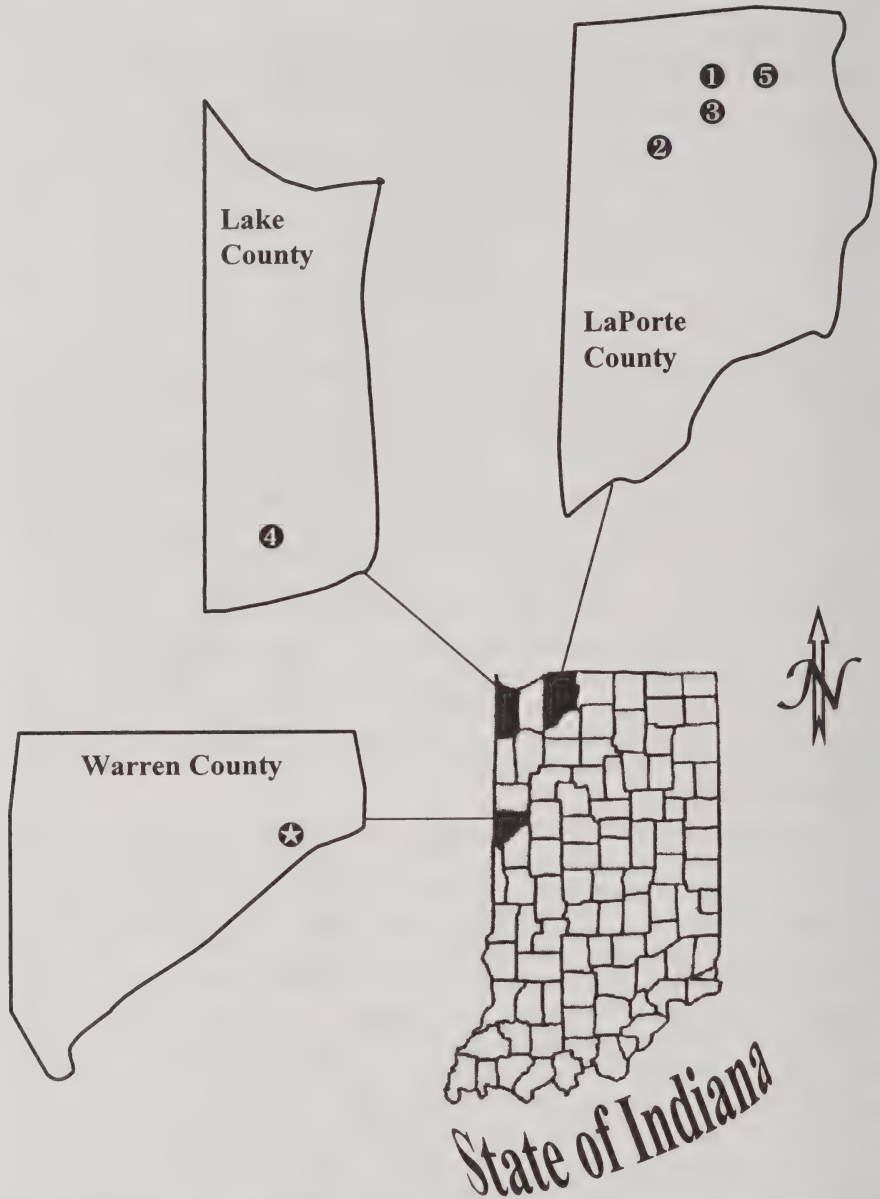


FIGURE 1. Distribution of *Wolffiella gladiata* in Indiana. Numbers represent the location and chronological order in which populations were discovered. The star represents an extant population at a site of historical occurrence.

On 20 June 1998, the first new location for *W. gladiata* in Indiana was recorded. While we were wading the shallows of Hog Lake, LaPorte County, we discovered a relatively large mat of *W. gladiata* 5 m east of the boat ramp at the lake's public access site. At this location, the sword bogmat was growing in a small isolated pool near the shoreline behind an extensive stand of *Nuphar advena* (Aiton) W. T. Aiton (spatterdock). The plants appeared to be exceptionally vigorous, covering 90% (9 m²) of the pool's surface. Further investigation of the nearshore habitat revealed small colonies of the sword bogmat within pockets of the dense *Nuphar* stand, which extended along most of the northern shore. The stand of *Nuphar* likely provided a barrier against wave action, preventing the small plants from being washed ashore. Other associated plant species included *Ceratophyllum demersum* L., *Ceratophyllum echinatum* A. Gray, *Lemna minor* L., *Lemna trisulca* L., *Riccia fluitans* L., (an aquatic liverwort) and *Wolffia columbiana* H. Karst.

Two months later an additional population of the sword bogmat was located in LaPorte County approximately 13 km southeast of Hog Lake. The plants were found in the southern bend of Horseshoe Lake, a highly eutrophic body of water on the northeast side of the city of LaPorte. *Wolffiella gladiata* formed colonies occurring as large clumps in and among the patches of spatterdock and *Nymphaea odorata* Aiton subsp. *tuberosa* (Paine) Wiersema & Hellq. (white water-lily). Throughout the shallow waters of the southern end of the lake, the sword bogmat was relatively common and found in association with *Ceratophyllum demersum*, *Ceratophyllum echinatum*, *Potamogeton strictifolius* A. Benn., and *Spirodela polyrrhiza* (L.) Schleid. A search of the unsheltered, developed portions of the lake yielded no additional plants of *W. gladiata*.

On 4 September 1998, a visit was made to Kates Pond in Warren County, a historical occurrence site for *W. gladiata*, where it was collected in 1937 by R. C. Friesner (his number 11112, deposited in BUT). Consistent with previous observations on habitats where the sword bogmat occurs, Kates Pond is located in an area where trees provide shade and shelter for much of the western portion of the pond. *Wolffiella gladiata* was flourishing at Kates Pond where it was growing in large clumps and forming large floating mats in association with *Azolla caroliniana* Willd. These two species were the most dominant free-floating species in the pond. Other associated species included *Ceratophyllum demersum*, *Ceratophyllum echinatum*, and *Lemna minor* L.

One year later, our investigations led us to Lake Maxinkuckee in Marshall County, which is the location of the first documented report of *W. gladiata* in Indiana (Coulter 1901). Coulter (1901) reported on the specimens collected by H. W. Clark (his number 618453 in US), which were growing near the Norris Inlet. Although we visited and extensively searched potential habitats on three different occasions throughout the growing season, no plants of *W. gladiata* were located. Most of the area around the lake has been extensively developed over the past hundred years, leaving only a small number of undisturbed strips of shoreline and a few sheltered bays.

On 8 July 1999, a third population of *W. gladiata* was discovered in LaPorte County at Prairie Pond located in Rolling Prairie approximately 2.5 km south-east of Hog Lake and 4.0 km northeast of Horseshoe Lake. A few submersed

colonies of the sword bogmat were located along the north shore, and a large floating mat was seen directly out from the dock along the nature trail. Although the pond is small, shallow, and perhaps ephemeral, having a total surface area of approximately 900 m² and a maximum depth of 2.5 m, it is nestled in a wooded area that provides shade and shelter for many free-floating aquatic plant species. The population of sword bogmat at this site was the smallest of those previously mentioned, contributing only a small percent to the total surface area of the floating mat, which was comprised of *Lemna minor*, *Lemna trisulca*, *Riccia fluitans*, *Spirodela polyrrhiza*, and *Wolffia columbiana*. Other associated species included *Ceratophyllum demersum*, *Ceratophyllum echinatum*, *Najas flexilis* L., *Nuphar advena*, *Nymphaea odorata* subsp. *tuberosa*, and *Potamogeton epihydrus* Raf.

The last two additional populations of sword bogmat were discovered during the field season of 2000. In May, *W. gladiata* was found in Redwing Lake, Lake County. Small colonies of these plants were growing in shallow water directly off both banks of the northern tip of the lake, which is bisected by 173RD Ave. These colonies were tucked away in small pockets along the shoreline. A search of the open waters yielded no additional plants. Plants growing in association with *W. gladiata* at Redwing Lake included *Ceratophyllum demersum*, *Ceratophyllum echinatum*, *Lemna minor*, and *Wolffia columbiana*. The second population was discovered at Silver Lake, LaPorte County. Silver Lake is located on the property of the Le Mans Academy in Rolling Prairie. This site currently represents the furthest east collection of *W. gladiata* in Indiana. Small mats were found along the east shore of the lake; however, plants occurred in colonies around much of the shoreline.

It is noteworthy to point out that at all locations we have visited and found *W. gladiata*, the plants appeared pale green and grew luxuriantly in relatively shaded and protected areas, but as bleached patches in open water. In addition, the most common free-floating, submerged associate of *W. gladiata* we have seen is *Ceratophyllum echinatum*. *Ceratophyllum echinatum* is an aquatic plant species new to the state of Indiana (Scribailo & Alix 2002), and like *W. gladiata*, it has a strong habitat preference for shaded and protected shorelines. This shade can take the form of overhanging trees or floating leaves of *Nuphar advena*. Unfortunately, *Nuphar advena* is one of the most commonly sprayed nuisance aquatic plant species in Indiana due to its prevalence and abundance in shallow eutrophic waters. Conservation initiatives should dictate that we develop a more intensive effort to identify as yet unknown populations of *W. gladiata* and other rare aquatic plant species from these types of locations prior to the approval of herbicide application permits. We have no doubts that additional effort will result in the discovery of other populations of this species. Our surveys of over 110 lakes and ponds in Indiana over the last five years have yielded well over 100 new records for state-listed aquatic plant species and the discovery of several species new to the state.

LaPorte Co.: Hog Lake, 41°42'20"N, 86°37'46"W, ca. 4 km north of Rolling Prairie, 20 Jun 1998, *M. S. Alix s.n.* (BUT); Horseshoe Lake, 41°38'38"N, 86°43'52"W, ca. 3 km north of LaPorte, 21 Aug 1998, *M. S. Alix s.n.* (BUT); Prairie Pond, Rolling Prairie, 41°40'57"N, 86°36'34"W, pond is located directly

behind Rolling Prairie Elementary School, 8 Jul 1999, *M. S. Alix s.n.* (BUT); Silver Lake, 41°41'32"N, 86°35'38"W, ca. 3 km northeast of Rolling Prairie, 7 Aug 2000, *M. S. Alix s.n.* (BUT).

Lake Co.: Redwing Lake, 41°18'9"N, 87°23'22"W, ca. 3 km northeast of Lowell, 20 May 2000, *M. S. Alix s.n.* (BUT).

Warren Co.: Kates Pond, 40°20'59"N, 87°11'54"W, ca. 2 km northwest of Independence, dense, 4 Sep 1998, *M. S. Alix s.n.* (personal collection).

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The authors wish to thank Dr. Rebecca Dolan at Butler University and Dan Nicolson at the U.S. National Herbarium for their assistance in interpreting herbarium specimen label data. In addition, a special thanks to Dr. Carole A. Lembi for the collecting trip to Kates Pond and Amy Huber with the Silver Lake Conservation Committee for access privileges to Silver Lake. Fieldwork for this study was supported by the Indiana Department of Natural Resources, Division of Nature Preserves.

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REVIEW

SEVENTH CATALOG OF THE VASCULAR PLANTS OF OHIO. By Tom S. Cooperrider, Allison W. Cusick, and John T. Kartesz, eds. 2001. x + 195 pages. Ohio State University Press, Columbus, OH (www.ohiostatepress.org). Hardcover ISBN 0-8142-0858-4; paperback ISBN 0-8142-5061-0.

This book is the most recent scion of a literary tree that first sprouted in 1860, with John S. Newberry's catalog of Ohio plants, but which has not borne fruit since John H. Schaffner's sixth catalog of 1932. It represents a collaboration of workers who have been in the forefront of Ohio floristic research for the past 40 years or more (contributors in addition to the editors were Barbara K. Andreas, Guy L. Denny, John V. Freudenstein, and John J. Furlow). As someone covered by its dedication (i.e., I've collected a fair number of plant specimens in Ohio over the years), I was much interested to see this volume.

The catalog is a list of all vascular plant species known to occur within the state of Ohio. The sequence of entries follows Cronquistian classification at the ranks of phylum, class, subclass, order, and family; species are alphabetical within families. To facilitate access for those of us who haven't memorized the Cronquist system yet, the book includes comprehensive indices to both scientific and vernacular names.

As for the nomenclature, rather than swearing allegiance to any one reference (e.g., the Gleason and Cronquist manual), the editors have attempted to use names that reflect the findings of recent taxonomic and nomenclatural research. Altogether, 2716 species of vascular plants are listed; only about 65% (1785) are regarded as native. The remainder comprise 507 naturalized aliens plus another 424 that are not yet naturalized. One hundred thirty-nine interspecific hybrids are recognized, 83% (115) of which involve native species.

The information provided for each species frankly is quite meager: scientific name with author, a common name or two, selected synonyms pertinent to Ohio. An asterisk denotes the naturalized aliens, a dagger the non-naturalized ones. No data on distribution, habitats, relative abundance/rarity, or threatened/endangered status are provided.

In a housekeeping vein, the authors provide a list of 132 taxa reported from the state whose presence could not be verified. At least one of these comes as a surprise. *Crataegus xmansfieldensis* Sarg. was expressly described on the basis of a specimen collected at Mansfield, Ohio! Given the nature of the type method, if this taxon doesn't occur in Ohio, where *does* it occur? The answer is apparently contained within a privately published and distributed checklist cited by the authors, which unfortunately is not to be found in our library.

In addition to the catalog *per se*, the book includes an excellent essay (by Denny and Cooperrider) on the natural history of the state's flora. It is essentially a thumbnail sketch of the major physiographic/biotic regions of Ohio, and will be of great utility and interest to anyone wanting a readily accessible snapshot of this topic.

Throughout, the book gives every evidence of great care and scholarship. No

typographical and factual errors came to my attention. Production values are high, and the layout and typesetting are most pleasing to the eye.

If I have any complaint about this book, it is one I have often raised about catalogs and checklists in general. As a practicing plant taxonomist, I am not sure just how a work such as this is to be used. Where does it fit on the botanist's bookshelf? Manuals and guides can be used to identify unknown specimens, and summarize information on distribution and ecology of the plants included. Monographs and revisions can perform a similar function, as well as providing detailed information on the relationships and biology of the taxa covered. Many questions can be answered with such works. With the present volume, very few questions can be addressed. For example, when I look at the entry for *Aconitum noveboracense* A. Gray, all I learn is that it is a native member of the Ranunculaceae that is called Northern or New York Monkshood, and that it is sometimes included in *A. columbianum* Nutt. I am left to wonder if it is widespread within Ohio or localized, common or rare; if it is a forest, prairie, or wetland species; if it is protected by state or federal laws. It seems to me that a catalog such as this could be rendered far more useful with the inclusion of such data. A perfect example is *The Vascular Plants of Iowa* by Lawrence J. Eilers and Dean M. Roosa (University of Iowa Press, 1994). The work is very similar to the Ohio catalog, but gives generalized statements of habitats, distribution within the state, and relative abundance for each species. By comparison, we learn from the Iowa catalog that *Aconitum noveboracense* (Northern Wild Monkshood) is a native member of the Ranunculaceae [sometimes treated as *A. columbianum* subsp. *noveboracense* (A. Gray) Hardin] that grows on moist limestone or sandstone cliffs and algific talus slopes, and that it is rare in central, northeastern, and east-central Iowa, having been documented in Allamakee, Clayton, Delaware, Dubuque, Hardin, and Jackson counties. In light of the long and distinguished history of floristic research in Ohio, it seems that it would have been possible without an inordinate amount of effort to have incorporated data of this sort into the Seventh Ohio Catalog. It is certainly something to consider for the Eighth.

—Thomas G. Lammers
Department of Biology and Microbiology
University of Wisconsin Oshkosh
Oshkosh, WI 54901
lammers@uwosh.edu

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Volume 39, numbers 1, 2, 3, and 4, was mailed on 2 April 2002.

On the cover: *Spiderwort (Tradescantia)*, showing the abundant hairs on the filaments.
Photographed by William C. Burger, 21 July 1996, at an unknown site.

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THE

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On all editorial matters, please contact: Neil A. Harriman, Editor, Biology Department, University of Wisconsin-Oshkosh, Oshkosh, WI 54901; 920. 424. 1002 (office); or at 5188 Bittersweet Lane, Oshkosh, WI 54901; 920. 233. 1973 (home); harriman@uwosh.edu – please use e-mail whenever possible.

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FLORA OF ST. HELENA ISLAND (STRAITS OF MACKINAC), MICHIGAN

Edward G. Voss

Herbarium, University of Michigan,
3600 Varsity Drive, Suite 112
Ann Arbor, Michigan 48108-2287

BACKGROUND

Islands have long fascinated people. They are home to mythological heroes and to monsters. They are refuges from daily life or they are destinations for (often ecologically damaging) intensive recreation. They come in all sizes, from the aptly named "Lone Tree Island" in the Isle Royale archipelago to entire continents. They inspire affectionate poetry and sayings. "If once you have slept on an island, You'll never be quite the same; . . ." (Rachel Field)

The subject of this report has fascinated me for as long as I can remember. Soon after my grandparents (in 1930) acquired a cottage on the Straits of Mackinac, west of Mackinaw City, the dim red blinking beacon of the lighthouse seemed to call from 8 miles across the water, on uninhabited St. Helena Island not far from the mainland of Mackinac County. Great rising plumes of smoke from a fire on St. Helena in the mid 1950s were visible from the cottage window. In 1958, Prentiss M. Brown, Jr., who had held an undivided two-thirds interest in St. Helena since about 1920, kindly granted me permission to botanize on the island, but not for 10 more years was it possible actually to set foot there for initial botanical exploration (thanks to a friendly boat-owning Mackinaw neighbor, John W. Childs).

In the summer of 2001 this island was acquired as a nature preserve by the Little Traverse Conservancy, financed by private donations. So it is timely to present a botanical inventory—a work long in progress, particularly for the benefit of visitors to the island.

The naming of St. Helena seems to be lost in obscurity. Apparently the oldest map to name it (in French, as were all maps printed in France) "I. Se. Helene" was published in 1744, the well known (and more than once reprinted) "Carte des Lacs du Canada . . ." by Jean Nicolas Bellin, engineer and hydrographer for the French navy. It was issued to accompany the first published edition of the journal of Father Pierre F. X. Charlevoix, recounting his travels to the western Great Lakes in 1721. The island is, however, not mentioned in Charlevoix's text. Did he learn of the name from local sources? Or did he christen it himself? Or did the name come to the map-maker's attention between 1721 and publication in 1744? And whom does it honor? In western New France, does it merely repeat the name of the island in the St. Lawrence River, at Montréal, christened by Samuel de Champlain in 1611, in honor of his wife, Hélène Boullé, "the first Frenchwoman of gentle birth to sail up the St. Lawrence" (Thomson 1966)?

(They had just been married early that year, before he returned to Québec.) Charlevoix passed through the Straits of Mackinac much earlier in the year than St. Helen's day (August 18—although in the Orthodox Church May 21 is the date). The map was published before Napoleon was even born, so his exile to an island of the same name off the coast of Africa could not have been relevant. However, the African island was discovered and named in 1502 (reputedly on May 21) by the Portuguese and was considered a pleasant, beautiful shelter—just as the island in Michigan. The volcanic African island is about 130 times the area of the Michigan one and rises to more than 2850 feet above sea level, so any further comparisons would be odious (see Ashmole & Ashmole 2000 for information on the other St. Helena). Perhaps our St. Helena was named directly in honor of St. Helen herself, wife of the Emperor Constantine and mother of Constantine the Great; she founded a number of churches, including the Church of the Nativity in Bethlehem A.D. 327. Then there was James le Moyne, Sieur de St. Hélène, who was born in Montréal in 1659 and received his name from the island there. He was a member of the party which arrived at the head of Hudson's Bay in June of 1686 and captured British forts there, giving France mastery of the southern part of Hudson's Bay. He was later mortally wounded fighting the British in 1690. One (if French) might have named an island in honor of such a hero.

St. Helena Island was of relatively little importance in the early fur-trading days, when canoes traveled close to the mainland shore, and it is doubtful whether native Americans ever regularly resided there, although it was "a favorite resort of theirs." (Davis 1947) The fishing industry and the ascendancy of the sailboat over the canoe, brought more usage to the deep-water and sheltered harbor on the northeast side of the island, facing the mainland a little more than a mile and a half to the northeast. Davis (1947) surmises that by 1849, when the island was patented to William Belote, there was probably quite a settlement on it, at least in the summer. With the advent of wood-burning steamships, St. Helena became a regular stop for firewood, as did other wooded islands in the Great Lakes. It seems to me quite possible that much of the island's forest was cut for fuel at this time. The only formal lumbering has been very little, for cedar posts (P. M. Brown, pers. comm.).

The Newton brothers (Archibald, Wilson, and Obadiah) bought out Belote about 1853 and the island remained in their family for many years. Mrs. Davis describes how they operated a large store, taking fish for marketing in payment and also buying furs, as well as tons of maple sugar from Cross Village. During the greatest prosperity of St. Helena—before the Civil War—merchants at Cheboygan and Mackinac Island would send to St. Helena for supplies when they ran out of groceries, for it was the only commercial establishment in many miles. It had a good library, and a school was conducted in the winter as well as summer. There was a time when Mormons from Beaver Island raided the fishermen of the region, even landing on St. Helena, and the Newtons nearly went bankrupt. After the Mormon "King Strang" was shot in 1856, it was men from St. Helena who led the expedition to drive the Mormons from Beaver Island. St. Helena was noted for its elegant parties, dances, and banquets into the 1880s.

A 71-foot-tall lighthouse was constructed at the southeast end of St. Helena in

1873 and first lit in September of that year; for many years a flashing red light, oil-powered, visible 13 miles, guided ships bound westward through the Straits of Mackinac. The light was changed to an automatic acetylene operation in 1922 and the keepers were discontinued in 1923. In November 1953 the power source was changed from acetylene to electricity. The light was later changed from flashing red to white. Still later, solar power prevailed and the white light now flashes every six seconds, year round but only at night. Restoration was started in 1986 by the non-profit Great Lakes Lighthouse Keepers Association, which continues to pay great care to authenticity, with much help from volunteers and Boy Scouts, especially Ann Arbor Troops (later merged) 4 and 61 (see Franklin 1991). In 1988 St. Helena Light Station was added to the National Registry of Historic Places. In 1997 the GLLKA received through legislative transfer a quit-claim deed to the Light Station (including 2 acres, the only portion of the island not in the new preserve).

Today there is little evidence of any other former human occupancy of the island—a few tumbledown timbers and foundations; spreading lilacs and other ornamentals at the “townsite” by the harbor; a child’s grave and some rotting rail fences in cedar thickets. The last permanent resident, with the permission of the owners, was a recluse named John Easton, whose good house burned in 1923, after which he moved into another old house, where he died in the 1950s. For many years, mainland residents turned their dogs loose on the island to keep them from being a nuisance in the summer. The interior of the island was severely burned in the mid 1950s.

BOTANICAL EXPLORATION

The first botanical records from this island date from August of 1810, when Thomas Nuttall evidently stopped there en route from Mackinac Island to Green Bay (Voss 1978). He was traveling with a fur-trading party on the way to his more distant destinations in the Northwest Territory. Unfortunately, no specimens nor entries in his diary exist for this portion of his journey. However, in his *Genera of North American Plants, and a Catalogue of the Species, to the year 1817*, published in 1818, Nuttall does make two explicit references to the island:

Primula farinosa [now known as *P. mistassinica*]: “On the calcareous gravelly shores of the Islands of Lake Huron; around Michilimakinak, Bois Blanc, and St. Helena, in the outlet of Lake Michigan: abundant, v. v. *sine fl.*” [the Latin abbreviation meaning seen alive without flowers]

Calypso americana [now included in *C. bulbosa*]: “v. v. *sine fl.* on the island of St. Helena, near the outlet of Lake Michigan, in the shade of *Abies canadensis* attached to recent vegetable soil. (1811).”

While the *Primula* (bird’s-eye primrose) is to this day common on St. Helena, the other reference is more problematic. The plant called “*Abies canadensis*” is now classified as *Tsuga canadensis*, hemlock, a tree not known at present on the island, nor is there much likely habitat for it. *Calypso*, the fairy slipper orchid,

may indeed be there in the shade of *Thuja* (white-cedar) or other conifers, but despite intensive search has not been discovered. Nuttall's date of "1811" is clearly wrong and perhaps his memory failed regarding locality as well as for dates (as in some other instances; cf. Pennell 1936, notes 17 & 20). Nuttall also cited from the Lake Michigan and Huron "islands," mentioning none by name, *Orchis* [*Platanthera*] *huronensis*, *Ribes lacustre*, *Tussilago* [*Petasites*] *palmata*, and *Taxus baccata* [*canadensis*]. Several other species were mentioned merely from shores, without explicit reference to islands. While Nuttall clearly was the first person with a professional interest in natural history to record any plant species from St. Helena Island, his contribution to a knowledge of that island is admittedly not large.

Somewhat more attention was given the island's flora by Newton H. Winchell in 1860. Douglass Houghton, Michigan's first State Geologist, had explored in the Straits area in 1838 and 1839, assisted by George Bull in 1839 (Voss 1956, 1978), but none of their plant specimens claim to be from St. Helena. The next State Geologist was Alexander Winchell, who was appointed in 1859. Like the first state survey, the second included botanical and zoological work. A. Winchell's younger brother, N. H. Winchell, who had just completed his second year as a University of Michigan student, was appointed "in the special capacity of botanical collector and assistant" for the 1860 season and accompanied exploring parties from Saginaw Bay around to Grand Traverse Bay. In his brother's biennial report, N. H. Winchell included a catalog (Winchell 1861) of the flora "growing wild in the Lower Peninsula of Michigan and the islands at the head of Lake Huron," compiled from various sources and including his own observations. For 10 species, St. Helena Island is specifically named, although documenting specimens have not been encountered. I have confirmed the existence of all upon the island over a century later, and list them below under the names presently used:

Barbarea vulgaris
Cardamine pensylvanica
Cornus canadensis
Diervilla lonicera
Galium triflorum

Halenia deflexa
Heracleum maximum
Mimulus glabratus var. *jamesii*
Ranunculus sceleratus
Veronica beccabunga var. *americana*

For a few of these records, dates are given, either August 10 or August 20. Over 30 species are recorded from the nearby mainland sites of Gros Cap and Pte. aux Chênes, with dates (if stated at all) of August 18, 19, or 20.

It is not completely clear, at this writing, who was the next botanical collector on St. Helena. Allen (Ann. Missouri Bot. Gard. 20: 165. 1933) cites a specimen of spurred gentian, *Halenia deflexa*, in the herbarium of the Brooklyn Botanic Garden, collected July 19, 1886. The label (of which I have seen a photocopy) bears a printed heading "Flora of the Northern United States" beneath which in smaller type is printed "Herb. Isabel S. Arnold." Handwritten at the beginning of this line is "Ex" and the handwritten data read "St. Helena Is. in N. Lake Michigan, July 19, 1886." There is nothing to indicate explicitly who actually collected the plant. Isabel S. Arnold (1858–1933) attended the Plainfield

Seminary in New Jersey, where she later taught and was head from 1906 until it closed in 1919.¹ While specimens of hers from New York are at Cornell and in the Brooklyn herbarium, no others from St. Helena have turned up (without extensive searching). It is possible that she received this specimen in an exchange. A collector who is known to have been in the region in 1886 is Frederick Wislizenus, Jr., son of the St. Louis physician who was associated with the celebrated botanist and physician, George Engelmann. The younger Wislizenus spent about a week (July 25–August 3) on North Manitou Island (northern Lake Michigan) in 1886. His specimens are in the herbarium of the Missouri Botanical Garden and include a few others from Mackinac Island dated August 7. Could he also have stopped at St. Helena Island en route to North Manitou?

DESCRIPTION OF THE ISLAND

St. Helena Island is often stated to be about 240 acres or a little more (about 100 hectares). A recent (low-water) figure is 266 acres. The actual area depends tremendously on the level of Lakes Michigan and Huron, for which the monthly average levels differ by more than six feet over a period of years. On gently sloping shores, a six-foot change in water level makes an enormous difference! The nearest mainland is at Gros Cap, 1.7 miles to the northeast and the deepest water between is 40–50 feet. The Mackinac Bridge crosses the Straits 7 miles to the east. The island is a little over a mile at its longest, oriented northwest/southeast, and about half a mile at its widest (Fig. 1). It is easily seen from U.S. Highway 2 in the Gros Cap area. Its low profile (compared with that of the mainland) is evident against the horizon (cf. Fig. 2).

The highest elevation on the island is a narrow strip barely above the 600-foot contour. Since the standard chart level datum is 577.5 feet for the lake, it is clear that the island rises very little above the modern lake surface. It is therefore a very young island, the highest part probably awash during the Algoma Stage in the Great Lakes, about 3000 years ago. Bedrock crops out and is breaking into more or less angular fragments along much of the shore of the island (especially at low water), presumably dolomite of the Pte. aux Chênes Formation of Late Silurian age (Landes, Ehlers, & Stanley 1945). Great and small storm ridges of angular to eroded and water-worn gravels (or “shingle”) occur along the present shore and as relics of earlier lake stages all across the island. Sandy beach is very scarce, with some at the harbor and a very little at the southeast end in low-water years. In such years, too, there are extensive moist gravelly flats laid open especially in the southern part of the island—ideal habitat for the bird’s-eye primrose

¹An obituary in the Plainfield *Courier News* for August 4, 1933, states that she graduated from Radcliffe, but Radcliffe College has no record of her. She is buried in Meriden, Connecticut, where tombstone records give her dates as November 20, 1858–August 2, 1933. I am indebted to archivists and researchers at Brooklyn Botanic Garden, Radcliffe College, Plainfield Public Library, Hunt Institute for Botanical Documentation, Connecticut Historical Society, and Missouri Botanical Garden for their valiant efforts to discover reliable (non-conflicting) information about Miss Arnold. No clue has yet appeared that she in fact was ever in Michigan or had any connections with St. Louis or with Wislizenus.



FIGURE 1. Aerial view of St. Helena Island, looking southwest (toward Lake Michigan). The large bay on the right is the "harbor" (former "townsite"). (Photo by Melissa Hansen, Little Traverse Conservancy, October 11, 2000)

that Thomas Nuttall saw as abundant in 1810. In years of highest water, on the other hand, the lighthouse is very nearly on a tiny satellite island of its own, surrounded by water or marsh. The soils map for Mackinac County (Whitney 1997, sheet 75) is less exact for St. Helena than the lines drawn on it would imply (compared to ground conditions). However, most of the island is shown as the "Esau-Zela Complex" with 0–3% slope—a ridge-swale complex of old gravelly beach ridges, with mucky depressions between them and a little litter. There are small areas of "Alpena Gravelly Loam" mapped, including a strip along the northeast shore, as well as a very few small areas of other rocky or mucky loams.

Clearings occur northwest of the lighthouse and at the old townsite by the harbor, and many introduced species grow in those places. Reconstruction and other activities around the lighthouse have also encouraged a number of weeds in open ground. At the lighthouse and (at least until recently) the townsite are fine stands of poison-hemlock (*Conium maculatum*). Poison-ivy (*Toxicodendron radicans*) is fairly local throughout but has long been rampant around the lighthouse and in the clearing northwest of it (which sometimes serves as a temporary campground, with potentially unpleasant consequences). The two main clearings are also being invaded by such shrubs and small trees as lilac (*Syringa vulgaris*) especially at the townsite, sumac (*Rhus*), choke cherry (*Prunus virginiana*), apple (*Malus pumila*), hawthorn (*Crataegus dodgei*), red-osier (*Cornus stolonifera*), and the ever-present cedar (*Thuja occidentalis*).



FIGURE 2. View toward the north from top of St. Helena lighthouse. Note old shorelines on higher elevations of the Upper Peninsula mainland in the distance. (Photo by E. G. Voss, July 2, 1994)

Cedar and balsam fir (*Abies balsamea*) are surely the most common conifers on the island, but there are also tamarack (*Larix laricina*) and a great deal of white spruce (*Picea glauca*). Paper birch (*Betula papyrifera*), quaking aspen (*Populus tremuloides*), balsam poplar (*Populus balsamifera*), with some ash (*Fraxinus pennsylvanica*), are the only other trees of note. When I first set foot in the interior of the island in 1968 there was little tree canopy in large areas of open aspect, especially toward the northwest end, with considerable evidence of fire within the previous 15 years or so (cf. Figs. 3 & 4) and much shrubbery, root suckers of *Populus*, and very young birch. By 1999, the interior looked much more mature (plenty of canopy shade and easier to penetrate, though still with difficult thickets).

A large marsh just north of the lighthouse is generally dry in low-water years when cut off by a bar on the east (see cover photo). It is fringed in places with large tamarack and cedar and is dominated by blue-joint grass (*Calamagrostis canadensis*) and water sedge (*Carex aquatilis*). Other graminoids and forbs, the species varying with water levels, share this marsh, and in most years there is in its midst a tiny nearly stagnant stream, the only site for mare's-tail (*Hippuris*), sweet-flag (*Acorus*), and one year, the yellow monkey-flower (*Mimulus glabratus*) seen on the island by Winchell in 1860.

Fairly abruptly, with no evident change in elevation, this marsh changes on the west into a typical old "beachpool" or meadow of almost marly gravels, such as occur all along the southwest side of the island and around its northwest end. Characteristic species (depending on season) include Ohio Goldenrod (*Solidago*



FIGURE 3. Interior view on St. Helena Island about a decade after fire. Note abundant aspen suckers surrounding the opening with goldenrod and charred stumps. (Photo by E. G. Voss, August 31, 1968)

ohioensis), gerardia (*Agalinis purpurea*), brook lobelia (*Lobelia kalmii*), fringed gentian (*Gentianopsis procera*), Pringle's aster (*Aster pilosus* var. *pringlei*), greenish sedge (*Carex viridula*), porcupine sedge (*Carex hystericina*), Crawe's sedge (*Carex crawei*), bird's-eye primrose, Indian paintbrush (*Castilleja coccinea*), meadow spikemoss (*Selaginella apoda*), silverweed (*Potentilla anserina*), spikerush (*Eleocharis elliptica*), rushes (*Juncus alpinus*, *J. nodosus*, *J. balticus*, etc.), panic grass (*Panicum implicatum* & *P. lindheimeri*), and calamint (*Calamintha arkansana*).

Of the species characteristically restricted in this region to sandy shores and dunes of the Great Lakes, only three have been found: Sea rocket (*Cakile eden-*



FIGURE 4. Interior view on St. Helena Island about three decades after fire. Balsam fir is thriving under older trees of quaking aspen. (Photo by E. G. Voss, September 2, 1989)

tula) and beach pea (*Lathyrus japonicus*), on shores more gravelly than often expected; Lake Huron tansy (*Tanacetum huronense*), extremely local and in some years not seen at all but the only plant on the island listed as threatened under Michigan's endangered species law. Although the island is very near the type localities and the habitats seem right, dwarf lake iris (*Iris lacustris*) and Houghton's goldenrod (*Solidago houghtonii*) have evaded intensive search. Both are federally (and state) listed as threatened and may yet turn up. Other interesting but undiscovered species for which ample right habitat seems to be present and which are locally common in other places around the Straits of Mackinac include false asphodel (*Tofieldia glutinosa*), butterwort (*Pinguicula vulgaris*), an additional spikemoss (*Selaginella selaginoides*), another spike-rush (*Eleocharis pauciflora* [*E. quinqueflora*]), and threesquare sedge (*Scirpus americanus* [*S. pungens*]).

Overall, the ferns and their allies seem to be under-represented on the island, compared to their diversity on the mainland. There is not even bracken (*Pteridium aquilinum*)! It is odd that there are no junipers, considering that both local species (*Juniperus communis* and *J. horizontalis*) are common in the region and can be easily dispersed by birds.

Recent immigrants that have become common throughout the island in recent years are helleborine (*Epipactis helleborine*) and the European marsh thistle

(*Cirsium palustre*), while the Eurasian water-milfoil (*Myriophyllum spicatum*) now thrives near the small dock at the lighthouse.

Invertebrates are numerous on the island and the six-legged kinds are sometimes too abundant. Among vertebrates, there is a noisy great blue heron rookery at the west end. Fresh pileated woodpecker diggings and nests are sometimes seen. Merlin and osprey nesting is also reported. Loons and other water birds patrol the shores. Deer, fortunately, are not known on the island but rabbits are common and evidence of their browsing is much seen. Little brown bats occupied the vandalized lighthouse before restoration and standard bat boxes are now provided for their convenience. Snakes, especially water snakes, are often seen.

St. Helena is not an ancient, well-isolated, oceanic island and does not display all the biological phenomena seen on such models for "island biogeography." Diversity of habitat is the chief feature supporting diversity of *plants* on such small, young, and slightly isolated places in the Great Lakes (cf. Hazlett 1988). The flora of St. Helena is quite respectable considering the island's youth, small size, and rather uniform habitat. It was connected with the mainland about 8000–9000 years ago, during the very low-water Lake Chippewa Stage in the history of Lake Michigan. Then it was submerged during the Nipissing Stage, which was at its peak about 5000 years ago, as crustal uplift raised the outlets that had drained the lakes 350–400 feet down to the Chippewa level. Only within the past 2000 years or so has the island become available for continuous occupancy by terrestrial plants and animals, so it presents different questions. *Iris lacustris* is found on islands with portions that were above the Nipissing Great Lakes. The seeds are dispersed by ants (Planisek 1983). Does its absence from St. Helena suggest that (1) this iris was dispersed in Nipissing times, moving down to present shores as waters receded; and (2) it is not being dispersed now across waters and hence has not gotten to St. Helena?

LIST OF THE SPECIES

Listed below are the 332 species of vascular plants of which occurrence on St. Helena has been verified by me. Of these, 261, or 79%, are presumed native, a slightly larger percentage than would be expected for the mainland flora. Species marked with an asterisk are not native, at least in this part of Michigan. Species marked with two asterisks are probably only surviving where planted but not much spreading. Ornamentals planted near the lighthouse are excluded. All species have been collected and/or seen by me on one or more of the following occasions: August 31, 1968; June 21, 1970, August 25, 1976; September 2, 1989; June 16, 1990; July 17, 1992; July 1–2, 1994; June 18–19, 1999; June 22 & September 1–2, 2001. Voucher specimens for over 92% of the species are mostly in herbaria of the University of Michigan (MICH) or the U-M Biological Station (UMBS). For only a few readily identified species are there no vouchers (because of neglect, too sparse a population, or too poor condition). My typical procedure on a visit has been to walk completely around the shore of the island, with side excursions into the interior or entirely across it. Additional time and at-

tention were given to particularly interesting habitats such as beach meadows, the rare sandy shores, mature conifers (where Nuttall's report of *Calypso* might be proved correct), wet swales and hollows. On three fractional days in 2001, I saw 70% of the listed species, although the main emphasis then was seeking additional ones and confirming certain questionable ones; many of the species, in other words, are common and readily noted.

Comments are sparse in this list. Most species can be assumed to occur in their expected habitats. Sequence of families and nomenclature for scientific names of seed-plants follow *Michigan Flora* (Voss 1972, 1985, & 1996), which can also be consulted for author citations if desired and for identifying characters.

SELAGINELLACEAE (Spikemoss Family)

Selaginella apoda (Meadow Spikemoss). [Our more northern plants are sometimes treated as a distinct species, *S. eclipes*.] Common to abundant on damp calcareous shores.

LYCOPODIACEAE (Clubmoss Family)

Lycopodium lucidulum (Shining Clubmoss). [Now often segregated in a different genus, as *Huperzia lucidula*.] Unusually scarce; first detected in 1994, northwest of the townsite, and seen in 2001 near the southwest shore.

EQUISETACEAE (Horsetail Family)

Equisetum arvense (Field Horsetail)

Equisetum variegatum (Variegated Scouring-rush)

OPHIOGLOSSACEAE (Adder's-tongue Family)

Botrychium spathulatum (Spatulate Moonwort). Specimen identified by W. H. Wagner, who named this rare species as new to science in 1990. It rather resembles the more common *B. minganense*.

Botrychium virginianum (Rattlesnake Fern)

POLYPODIACEAE (sens. latiss.) (Fern Family)

Dryopteris cristata (Crested Wood Fern)

Dryopteris intermedia (Fancy Fern)

Dryopteris spinulosa (Spinulose Wood Fern)

Gymnocarpium dryopteris (Oak Fern)

Thelypteris palustris (Marsh Fern)

TAXACEAE (Yew Family)

Taxus canadensis (Ground-hemlock; Yew)

PINACEAE (Pine Family)

Abies balsamea (Balsam Fir)

Larix laricina (Tamarack; Larch)

Picea glauca (White Spruce)

CUPRESSACEAE (Cypress family)

Thuja occidentalis (White-cedar; Arborvitae). Common and sometimes of considerable size.

Trees on an old storm ridge next to the high-water line on the southwest side are as large as 23 inches in diameter. A tree 19 inches in diameter on a small (presumably child's) grave east of the townsite is reported to have shown 132 rings in a core taken 10 feet above ground (where the trunk was no longer hollow).

TYPHACEAE (Cat-tail Family)

Typha latifolia (Common Cat-tail)

POTAMOGETONACEAE (Pondweed Family)

Potamogeton filiformis (Threadleaf Pondweed). Locally abundant in pools between storm ridges on the northwest shore, 1976.

Potamogeton foliosus. Local, with *Myriophyllum spicatum* and *Elodea*, in shallow water by the dock at the lighthouse in 2001. Although sterile, presumably this species rather than *P. pusillus*.

Potamogeton gramineus. In nearly stagnant stream through the marsh north of the lighthouse.

Potamogeton richardsonii. Common in a pool between storm ridges along the northeast shore, 1976.

NAJADACEAE (Naiad Family)

Najas flexilis (Water-nymph)

JUNCAGINACEAE (Arrow-grass Family)

Triglochin maritimum (Arrow-grass)

ALISMATACEAE (Water-plantain Family)

Sagittaria latifolia (Arrowhead; Wapato)

GRAMINEAE (POACEAE) (Grass Family)

Agropyron trachycaulum (Wheatgrass)

Agrostis gigantea (Redtop)*

Agrostis hyemalis (Ticklegrass)

Agrostis perennans (Autumn Bent)

Calamagrostis canadensis (Blue-joint)

Calamagrostis inexpansa

Deschampsia cespitosa (Hair Grass)

Elymus canadensis (Wild-rye)

Festuca occidentalis (Western Fescue). This grass, disjunct in the upper Great Lakes region from western North America (Marquis & Voss 1981), is widespread on the island, often seen with *Linnaea*, *Polygala*, and *Trientalis*.

Glyceria striata (Manna Grass)

Leersia oryzoides (Cut Grass). Plants not yet blooming in marsh north of lighthouse in 1992 but not seen since.

Panicum capillare (Witch Grass). First noted in 2001 at two places.

Panicum implicatum (Panic Grass)

Panicum lindheimeri (Panic Grass)

Phalaris arundinacea (Reed Canary Grass)

Phleum pratense (Timothy)*

Poa compressa (Canada Bluegrass)*

Poa palustris (Fowl Meadow Grass)

Poa pratensis (Kentucky Bluegrass)*

Sphenopholis intermedia (Wedgrass)

CYPERACEAE (Sedge Family)

Carex aquatilis (Water Sedge)

Carex aurea (Golden Sedge)

Carex bebbii

Carex buxbaumii

Carex capillaris (Hair Sedge)

Carex crawei

Carex crinita (Fringed Sedge)

Carex deweyana

Carex diandra

Carex disperma

Carex eburnea

Carex flava (Yellow Sedge)

Carex garberi

Carex gracillima (Slender Sedge)
Carex hystericina (Porcupine Sedge)
Carex interior (Inland Sedge)
Carex peckii
Carex pseudocyperus
Carex rosea [= *C. radiata*]
Carex retrorsa (Hooked Sedge)
Carex rostrata (Beaked Sedge)
Carex sterilis
Carex stipata (Crowded Sedge)
Carex stricta (Tussock Sedge)
Carex umbellata (Sand Sedge)
Carex viridula (Greenish Sedge)
Carex vulpinoidea (Fox Sedge)
Cladium mariscoides (Twig-rush)
Eleocharis acicularis (Spike-rush)
Eleocharis elliptica (Spike-rush)
Eleocharis smallii (Spike-rush)
Rhynchospora capillacea (Beak-rush)
Scirpus acutus (Hardstem Bulrush)
Scirpus validus (Softstem Bulrush)

ARACEAE (Arum Family)

Acorus calamus (Sweet-flag). First noted in 1999 as local in the marsh north of the lighthouse.
Arisaema triphyllum (Jack-in-the-pulpit). First noted in 1999; apparently quite local in woods of cedar and tamarack or cedar and fir.

JUNCACEAE (Rush Family)

Juncus alpinus
Juncus balticus
Juncus brevicaudatus
Juncus dudleyi
Juncus nodosus

LILIACEAE (Lily Family)

Allium canadense (Wild Garlic). Locally common in the meadow-clearing north of the lighthouse. The strong odor when bruised will readily identify an *Allium*.
Asparagus officinalis (Garden Asparagus)**. Local in an old clearing at the townsite; still evident in 2001.
Clintonia borealis (Bluebead-lily; Corn-lily)
Lilium philadelphicum (Wood Lily)
Maianthemum canadense (Wild or False Lily-of-the-valley; Canada Mayflower)
Polygonatum pubescens (Solomon-seal)
Smilacina stellata (Starry False Solomon-seal)
Streptopus roseus (Twisted-stalk)
Trillium cernuum (Nodding Trillium). Apparently scarce and seen at the edge of cedar woods by an old clearing near the lighthouse and in similar habitat at the west end of the island. None of the trillium so common in northern Michigan, *T. grandiflorum*, have been seen on the island.
Zigadenus glaucus (White Camas). Quite local, in old damp beachpools at northwest end of the island. All parts of the plant, including the bulbs, are toxic if eaten (although not lethal in any practical quantity). The absence of an onion odor will distinguish this plant from any onion or garlic, as will the elongate inflorescence (individual flower stalks not radiating from a single point as in onions).

IRIDACEAE (Iris Family)

Iris versicolor (Wild Blue Flag)
Sisyrinchium montanum (Blue-eyed-grass)

ORCHIDACEAE (Orchid Family)

Corallorhiza striata (Striped Coral-root)

Corallorhiza trifida (Early Coral-root)

Cypripedium calceolus (Yellow Lady-slipper)

Cypripedium reginae (Showy Lady-slipper). Very local, but numerous, not far north of the lighthouse.

Epipactis helleborine (Helleborine)*. Shoots (foliage) of this alien orchid were first noticed in 1994 in woods of fir and cedar at the west end of the island, near old rail fences. Five years later, the species was frequent throughout, especially under cedar, and it continues to spread everywhere, the tallest seen measuring 37 inches.

Goodyera oblongifolia (Rattlesnake-plantain)

Habenaria hyperborea (Tall Northern Bog Orchid)

Liparis loeselii (Fen Orchid; Loesel's Twayblade)

Malaxis monophylla (White Adder's-mouth). Scarce in damp moss among old charred stumps near the southwest shore, seen only in 1992.

SALICACEAE (Willow Family)

Populus balsamifera (Balsam Poplar; Hackmatack)

Populus tremuloides (Quaking Aspen)

Salix bebbiana (Beaked Willow)

Salix candida (Sage Willow)

Salix discolor (Pussy Willow)

Salix exigua (Sandbar Willow). Not nearly as common as one might expect, but small shrubs are on the shore north of the lighthouse.

Salix eriocephala

Salix fragilis (Crack Willow)*. A many-trunked tall shrub at the gravelly shore just north of the lighthouse.

Salix lucida (Shining Willow)

Salix petiolaris (Slender Willow)

MYRICACEAE (Bayberry Family)

Myrica gale (Sweet Gale). New shoots found in 1999 on an old stem evidently recently emerged after high water, on cobbly shore on west side of the island. Not noted in prior years.

BETULACEAE (Birch Family)

Betula papyrifera (White, Paper, or Canoe Birch). A common tree. One at the east end of the island measured 35–36 inches in diameter (the tree is on a mound surrounded by dense yew thickets, so measurement was probably taken higher than traditional "breast height").

URTICACEAE (Nettle Family)

Urtica dioica (Stinging Nettle)

SANTALACEAE (Sandalwood Family)

Comandra umbellata (Bastard or False Toadflax)

POLYGONACEAE (Smartweed Family)

Polygonum amphibium (Water Smartweed)

Polygonum convolvulus (Black-bindweed; False Buckwheat)*

Polygonum lapathifolium (Nodding Smartweed)

Polygonum persicaria (Lady's-thumb)*

Polygonum punctatum (Water Smartweed)

Polygonum ramosissimum (Bushy Knotweed). Usually a good crop of this species on both the north/northeast and south/southwest shores.

Rheum rhaponticum (Rhubarb)**. Undoubtedly surviving from old cultivation back of the townsite. Not seen recently and perhaps now died out.

Rumex crispus (Curly Dock)*

Rumex obtusifolius (Bitter Dock)*. One large plant seen near the lighthouse in 2001.

CHENOPODIACEAE (Goosefoot Family)

*Chenopodium glaucum**. Scarce; one plant in 1989 on shore of harbor at townsite.

CARYOPHYLLACEAE (Pink Family)

Arenaria serpyllifolia (Sandwort)*

Cerastium fontanum (Mouse-ear Chickweed)*

Silene pratensis (White Campion)*

Silene vulgaris (Bladder Campion)*

Stellaria calycantha [C. borealis] (Northern Stitchwort)

Stellaria longifolia (Stitchwort)

RANUNCULACEAE (Buttercup Family)

Actaea rubra (Red Baneberry) [also f. *neglecta*, its white-fruited form]

Anemone canadensis (Canada Anemone)

Anemone cylindrica (Thimbleweed)

Anemone virginiana (Thimbleweed)

Aquilegia canadensis (Wild Columbine)

Caltha palustris (Marsh-marigold)

Clematis virginiana (Woodbine; Virgin's Bower)

Ranunculus acris (Common Buttercup)*

Ranunculus hispidus (Swamp Buttercup)

Ranunculus sceleratus (Cursed Crowfoot)

Thalictrum dasycarpum (Purple Meadow-rue)

Thalictrum venulosum (Northern Meadow-rue). Local at edge of thickets in the old clearing north of the lighthouse. Although listed as "threatened" in Michigan when the species was found here in 1990, its status has since been "upgraded" to "special concern."

FUMARIACEAE (Fumitory Family)

Corydalis aurea (Golden Corydalis). A few plants in 1989 on fine gravel on the southwest shore; surely will appear again in its characteristic habitat: freshly disturbed soil.

CRUCIFERAE (BRASSICACEAE) (Mustard Family)

Arabis glabra (Tower Mustard). Locally frequent in an old field at the townsite in 2001.

Barbarea orthoceras. Locally frequent on limestone gravels along the shore. Very similar to the next species.

Barbarea vulgaris (Yellow Rocket)*

Berteroa incana (Hoary Alyssum)*. First noted in 1994 near the lighthouse and now common there.

Cakile edentula (Sea-rocket). Scattered along gravelly shores, including both var. *edentula* and var. *lacustris*. In some years, not seen at all despite search.

Capsella bursa-pastoris (Shepherd's-purse)*. Local weed by the lighthouse, 1999.

Cardamine pensylvanica (Bitter Cress)

Erysimum cheiranthoides (Wormseed Mustard)*

Lepidium campestre (Pepper-grass)*

Nasturtium officinale (Watercress)*

Rorippa palustris (Yellow Cress)

Thlaspi arvense (Penny Cress)*. Scarce weed by the lighthouse, 1999.

CRASSULACEAE (Orpine Family)

Sedum acre (Mossy Stonecrop)*

SAXIFRAGACEAE (Saxifrage Family)

Mitella nuda (Naked Mitrewort)

Parnassia glauca (Grass-of-Parnassus)

GROSSULARIACEAE (Gooseberry Family)

Ribes americanum (Wild Black Currant)

Ribes hirtellum (Swamp Gooseberry)

Ribes lacustre (Swamp Black Currant)

ROSACEAE (Rose Family)

Agrimonia gryposepala (Agrimony).

Amelanchier arborea (Serviceberry; Juneberry)

Amelanchier sanguinea (Serviceberry; Juneberry)

Crataegus dodgei (Hawthorn). A tall shrub in the old clearing north of the lighthouse; the plants are referable to var. *lumaria*.

Fragaria virginiana (Wild Strawberry)

Geum aleppicum (Avens)

Geum rivale (Water Avens)

Malus pumila (Apple)**. Some trees doubtless planted, but also apparently adventive.

Physocarpus opulifolius (Ninebark)

Potentilla anserina (Silverweed)

Potentilla fruticosa (Shrubby Cinquefoil)

Potentilla norvegica (Rough Cinquefoil)*

Prunus pensylvanica (Pin or Fire Cherry)

Prunus pumila (Sand Cherry)

Prunus virginiana (Choke Cherry). An unusual specimen is a several-stemmed tall tree (35–40 feet?) by the lighthouse.

Rosa acicularis (Wild Rose)

Rosa blanda (Wild Rose)

Rosa eglanteria (Sweetbrier)**. A few shrubs spreading or suckering in grassy field at the old townsite, perhaps not far from where once planted.

Rubus pubescens (Dwarf Raspberry)

Rubus strigosus (Wild Raspberry)

Rubus sp. (Blackberry)

Sorbus decora (Mountain-ash). Not common, but one tree, about 12 inches in diameter, is on the west side of the island and the species has probably been overlooked elsewhere.

LEGUMINOSAE (FABACEAE) (Pea Family)

Lathyrus japonicus (Beach Pea)

Lathyrus palustris (Marsh Pea)

Medicago lupulina (Black Medick)*

Melilotus alba (White Sweet-clover)*

Trifolium hybridum (Alsike Clover)*

Trifolium pratense (Red Clover)*

Trifolium repens (White Clover)*

Vicia sativa (Spring Vetch)*. Very scarce; found only at the edge of a thicket at the townsite.

GERANIACEAE (Geranium Family)

Geranium robertianum (Herb Robert). Very common on drier gravelly shores.

POLYGALACEAE (Milkwort Family)

Polygala paucifolia (Fringed Polygala; Gay-wings). This colorful species illustrates well the chill microclimate of the island, for plants may still be in bloom into late June, with wing petals yet attached, while at the same time (in the same year) plants along the south side of the Straits are all finished blooming.

ANACARDIACEAE (Cashew Family)

Rhus x-pulvinata (Hybrid Sumac)

Rhus typhina (Staghorn Sumac)

Toxicodendron radicans (Poison-ivy). Locally common to abundant, especially near the lighthouse and townsite. Many people have an allergic reaction (dermatitis) when their skin comes in contact with the oil contained in this plant.

ACERACEAE (Maple Family)

Acer negundo (Box-elder)*. Seedling noted in 1994 on the shore west of the lighthouse.

Acer platanoides (Norway Maple)*. A few seedlings in 1990 on upper damp gravelly south shore of the island. Readily recognized by milky sap in the petioles.

Acer rubrum (Red Maple)

Acer spicatum (Mountain Maple)

BALSAMINACEAE (Touch-me-not Family)

Impatiens capensis (Spotted Touch-me-not; Jewelweed). Locally abundant in damp ground, forming extensive carpets, but conspicuous only late in the summer, when blooming.

VITACEAE (Grape Family)

Vitis riparia (River-bank Grape)

MALVACEAE (Mallow Family)

Malva moschata (Musk mallow)*

Malva neglecta (Common Mallow; Cheeses)*. Very local at townsite.

GUTTIFERAE (CLUSIACEAE) (St. John's-wort Family)

Hypericum kalmianum (Kalm's St. John's-wort)

Hypericum perforatum (Common St. John's-wort; Klamath Weed)*

VIOLACEAE (Violet Family)

Viola conspersa (Dog Violet)

Viola nephrophylla (Northern Bog Violet)

Viola renifolia (Kidney-leaved Violet)

Viola sororia (Common Blue Violet)

ELAEAGNACEAE (Oleaster Family)

Shepherdia canadensis (Buffalo-berry; Soapberry). Locally a common shrub, readily tolerating alkaline conditions whether damp or dry in open ground.

ONAGRACEAE (Evening-primrose Family)

Circaea alpina (Enchanter's-nightshade)

Epilobium angustifolium (Fireweed)

Epilobium ciliatum (Willow-herb)

Epilobium hirsutum (Great Hairy Willow-herb)*. Four unmistakable shoots seen in meadow south of lighthouse in 1992, but not found in subsequent years despite expectations that the species would spread.

Epilobium leptophyllum (Willow-herb)

Oenothera oakesiana (Evening-primrose)

Oenothera parviflora (Evening-primrose)

HALORAGACEAE (Water-milfoil Family)

Myriophyllum ?exalbescens (Water-milfoil). Common but sterile in a pool between storm ridges on northeast shore, 1976.

Myriophyllum spicatum (Eurasian Water-milfoil)*. Common, rooted in sandy substrate in Straits of Mackinac in shallow water at dock near lighthouse, first recorded in 1999.

Proserpinaca palustris (Mermaid-weed)

HIPPURIDACEAE (Mare's-tail Family)

Hippuris vulgaris (Mare's-tail). Very local, 1999, in water about 2 inches deep in nearly stagnant stream through marsh north of lighthouse. No submersed foliage present but many emersed stems flowering.

ARALIACEAE (Ginseng Family)

Aralia nudicaulis (Wild Sarsaparilla)

UMBELLIFERAE (APIACEAE) (Carrot or Parsley Family)

Cicuta bulbifera (Water-hemlock). Not as common as the next, but likewise poisonous.

Cicuta maculata (Water-hemlock). Rather frequent, especially in shore meadows. Poisonous if eaten.

Conium maculatum (Poison-hemlock)*. Locally common and conspicuous near lighthouse and (at least formerly) at the townsite, with tall purple-spotted stems and rounded clusters of white flowers. Deadly poisonous if taken internally.

Heracleum maximum (Cow-parsnip). Easily distinguished from the preceding although equally tall, but with flat-topped clusters of white flowers.

Osmorhiza chilensis (Sweet-cicely). Like *Festuca occidentalis*, a species disjunct from western North America (also from South America!), locally frequent on the island. (See Marquis & Voss 1981.)

Pastinaca sativa (Wild Parsnip)*

Sanicula marilandica (Black Snakeroot)

CORNACEAE (Dogwood Family)

Cornus canadensis (Bunchberry; Dwarf Cornel)

Cornus rugosa (Round-leaved Dogwood)

Cornus stolonifera (Red-osier)

PYROLACEAE (Shinleaf or Wintergreen Family)

Orthilia secunda (One-sided Shinleaf)

Pyrola asarifolia (Pink Pyrola)

Pyrola chlorantha. Surprisingly scarce when there is so much coniferous habitat. Only a few plants discovered in 1999 on the west side of the island.

MONOTROPACEAE (Indian-pipe Family)

Monotropa uniflora (Indian-pipe)

ERICACEAE (Heath Family)

Arctostaphylos uva-ursi (Bearberry)

PRIMULACEAE (Primrose Family)

Lysimachia thyrsiflora (Tufted Loosestrife)

Primula mistassinica (Bird's-eye Primrose). Abundant in damp meadows and gravelly shores.

Trientalis borealis (Starflower)

OLEACEAE (Olive Family)

Fraxinus pennsylvanica (Red or Green Ash)

Syringa vulgaris (Lilac)*. Clearly spreading from old cultivation and very well established.

GENTIANACEAE (Gentian Family)

Gentianopsis procera (Fringed Gentian). Locally frequent on damp gravelly shores and meadows. St. Helena has a reputation for good displays of this species. Mackinaw City author Frances Margaret Fox, in a 1936 book designed for children, tells of an Indian legend relating to St. Helena "which even now is one of the loveliest spots on earth." An Indian maiden, whose name meant "fringed gentian," leapt from the summit of Gros Cap to avoid an unwanted arranged marriage. She was rescued by the strong arms of a young warrior who carried her in his canoe to St. Helena, where "they lived happily ever after" and wherever she wandered on the island, fringed gentians sprang up in her footsteps. (See also Davis 1947.)

Halenia deflexa (Spurred Gentian)

APOCYNACEAE (Dogbane Family)

Apocynum androsaemifolium (Spreading Dogbane). Surprisingly local, but there is some near the heron rookery.

ASCLEPIADACEAE (Milkweed Family)

Asclepias syriaca (Common Milkweed)

POLEMONIACEAE (Phlox Family)

Phlox subulata (Moss-pink)*. Locally abundant at townsite.

BORAGINACEAE (Borage Family)

Cynoglossum officinale (Hound's-tongue)*. Our native species, *C. boreale*, is surely to be expected but has not been seen.

Lithospermum officinale (Gromwell)*

Myosotis arvensis (Forget-me-not)*

LABIATAE (LAMIACEAE) (Mint Family)

Calamintha arkansana (Calamint)

Clinopodium vulgare (Wild-basil; Dog-mint)

Galeopsis tetrahit (Hemp-nettle)*

Glechoma hederacea (Ground-ivy; Creeping Charlie)*

Lycopus americanus (Water-horehound; Bugleweed)

Lycopus uniflorus (Water-horehound; Bugleweed)

Mentha arvensis (Wild Mint)

Nepeta cataria (Catnip)*

Prunella vulgaris (Self-heal; Heal-all)

Scutellaria galericulata (Marsh Skullcap)

Scutellaria lateriflora (Mad-dog Skullcap)

SOLANACEAE (Nightshade Family)

Solanum dulcamara (Nightshade; Bittersweet)*. Surprisingly scarce; a single plant found in 2001 on a recently exposed gravelly flat south of the lighthouse.

Solanum ptychanthum (Black Nightshade). A single plant found in 2001 at the water's edge on a recently exposed gravelly flat south of the lighthouse. Presumably berries of this species and the preceding had washed in quite recently.

SCROPHULARIACEAE (Snapdragon Family)

Agalinis purpurea (Gerardia). Frequent on damp shores, but scarcely noticeable except when in bloom late in the summer.

Castilleja coccinea (Indian Paintbrush). Some plants occur with the tips of the bracts yellow rather than red.

Linaria vulgaris (Butter-and-eggs)*

Mimulus glabratus var. *jamesii* (Monkey-flower). Local along tiny stream in marsh north of lighthouse; found only in 1990.

Mimulus ringens (Monkey-flower)

Verbascum thapsus (Mullein; Flannel-plant)*

Veronica anagallis-aquatica (Water Speedwell). Often abundant on damp shores, especially at the northwest end of the island.

Veronica arvensis (Field Speedwell)*

Veronica beccabunga var. *americana* (Brooklime)

Veronica serpyllifolia (Thyme-leaved Speedwell)*

RUBIACEAE (Madder Family)

Galium brevipes (Bedstraw)

Galium palustre (Marsh Bedstraw)

Galium trifidum (Bedstraw)

Galium triflorum (Bedstraw)

CAPRIFOLIACEAE (Honeysuckle Family)

Diervilla lonicera (Bush-honeysuckle). An abundant shrub, especially on dry more or less open gravel ridges.

Linnaea borealis (Twinflower)

Lonicera canadensis (Fly Honeysuckle)

Lonicera dioica (Glaucous Honeysuckle)

Lonicera hirsuta (Hairy Honeysuckle)

Sambucus racemosa (Red Elderberry)

Viburnum opulus (Highbush-cranberry)

CAMPANULACEAE (Bellflower Family)

- Campanula aparinoides* (Marsh Bellflower)
Campanula rapunculoides (Creeping Bellflower)*
Campanula rotundifolia (Bluebell; Harebell)
Lobelia kalmii (Kalm's or Brook Lobelia)

COMPOSITAE (ASTERACEAE) (Aster Family)

- Achillea millefolium* (Yarrow)
Anaphalis margaritacea (Pearly Everlasting)
Arctium minus (Burdock)*
Artemisia campestris (Wild Wormwood). A few plants on the gravelly shore northwest of the townsite.
Aster ciliolatus (Lindley's Aster). Also some apparent hybrids.
Aster lateriflorus (Calico Aster)
Aster puniceus var. *firmus* (Swamp Aster)
Aster pilosus var. *pringlei* (Pringle's Aster). Some plants have pink rays rather than the usual white, and some of these have unusually short rays. Altogether, an abundant aster on the island shores.
Bidens cernuus (Bur-marigold)
Bidens frondosus (Devil's Beggar-ticks)
Centaurea maculosa (Spotted Knapweed)*. A sterile seedling seen on gravelly shore, north side of island, in 1994. A terrible weed on the mainland and should be exterminated on the island. All three plants seen in 2001 suffered this fate.
Chrysanthemum leucanthemum (Ox-eye Daisy)*
Cirsium arvense (Canada Thistle)*
Cirsium palustre (European Marsh Thistle)*. First noted in 1990 on the south shore near the lighthouse; evidently well established but local. Now common throughout, an obnoxious, ugly, exotic weed of damp ground.
Cirsium vulgare (Bull Thistle)*. Has become common in recent years.
Conyza canadensis (Horseweed)
Erigeron philadelphicus (Fleabane)
Eupatorium maculatum (Joe-pye Weed)
Eupatorium perfoliatum (Boneset)
Euthamia graminifolia (Flat-topped Goldenrod)
Helianthus annuus (Common Sunflower)*. A single waif on the northeast shore in 1989.
Hieracium aurantiacum (Orange Hawkweed; Devil's Paintbrush)*
Hieracium piloselloides (King Devil)*. Plants with heads of intermediate color suggest that this yellow-flowered species may be hybridizing with the preceding one near the lighthouse.
Lactuca muralis (Wall Lettuce)*
Petasites frigidus (Sweet-coltsfoot)
Prenanthes racemosa (Rattlesnake-root)
Rudbeckia hirta (Black-eyed-Susan)
Senecio aureus (Golden Ragwort)
Senecio pauperculus (Ragwort)
Solidago altissima (Tall Goldenrod)
Solidago canadensis (Canada or Common Goldenrod)
Solidago ohioensis (Ohio Goldenrod)
Sonchus arvensis (Sow-thistle)*
Tanacetum huronense (Lake Huron Tansy). Very local and intermittent, showing in years of lower water on small sandy-gravelly areas both west and north of the lighthouse as well as near the harbor and westward.
Taraxacum officinale (Dandelion)*
Tragopogon dubius (Goat's-beard)*
Tragopogon pratensis (Goat's-beard)*

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John W. Childs and Richard L. Moehl have rendered the indispensable service of providing transportation to St. Helena. Dick Moehl and Sandy Planisek have further been most hospitable on the island and reviewed an early draft of the manuscript. Others who have rambled with me on St. Helena, calling attention to interesting features and/or offering another pair of eyes in the field include Kurt Childs, Jack Edwards, Eric Hellquist, R. J. Planisek, and Gary R. Williams, as well as several family members. W. H. Wagner, Jr., Richard K. Rabeler, and A. A. Reznicek have helped with identifications of pteridophytes, Caryophyllaceae, and sedges, respectively. Prentiss M. Brown, Jr., was helpful in early correspondence. William R. Farrand offered geological advice. Gary Williams skillfully dealt with preparing the photos, all originally in color, for publication, including the two made available by the Little Traverse Conservancy. To all I am grateful!

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On the Cover: *Aerial view west across the southwest end of St. Helena Island,
Straits of Mackinac, Michigan. The lighthouse is in the foreground.
Note patches of deciduous trees (paler) amidst conifers.
(Photo by Melissa Hansen, Little Traverse Conservancy, October 11, 2000)*

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THE

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A VASCULAR FLORA OF THE NORWEGIAN BAY WETLANDS ON GREEN LAKE, GREEN LAKE COUNTY, WISCONSIN

Thomas L. Eddy

426 Walker Avenue
Green Lake, Wisconsin 54941
tleddy@vbe.com

ABSTRACT

The Norwegian Bay Wetlands (NBW) are located along the western shore of Norwegian Bay on Green Lake, in Green Lake County, Wisconsin. The property, which is held in trust by the Green Lake Sanitary District, encompasses 20.5 acres, including nearly 700 feet of lake frontage.

During this study, 248 vascular plants were collected and identified from the NBW, of which 71 families and 157 genera are represented. All voucher specimens were deposited at OSH. The number of documented species represents 26% of the total county flora, including seven species that are recognized as county records (Eddy 1996, 1999).

Additionally, three species from the NBW are cited in Wisconsin's threatened and endangered species list: *Tofieldia glutinosa* is a state threatened species, while *Calamagrostis stricta* and *Gentianopsis procera* are listed as special concern (WDNR 1999).

Based on knowledge of the present-day NBW flora, a review of the original land survey records, and anecdotal information collected from personal interviews, an overview of past land uses and changes in vegetation is presented.

INTRODUCTION

The Norwegian Bay Wetlands (NBW) comprise part of the largest area of undeveloped shoreland along the western shore of Norwegian Bay on Green Lake, in Green Lake County, Wisconsin (Fig. 1). The bay varies in depth from 3 to 175 feet and is located on the northwest side of Wisconsin's deepest inland lake at 236 feet. Historically, the westernmost rim of the bay was a shallow sand and muck-filled flat, stippled with extensive beds of hardstem bulrush, *Scirpus acutus*, and aquatic submergents (*Potamogeton*, *Elodea*, *Vallisneria*, *Zosterella*, *Zannichellia*).

In 1845, when the first dam was built near the head of Green Lake's main outlet, the raised lake levels resulted in flooding of the original shoreline and contributed to a decline in the littoral zone. The natural shoreland buffer was further diminished by the dredging of a boat canal off the southwest corner of Norwegian Bay and the subsequent development of lakeshore properties. Piers and heavy boat traffic have since become the norm.

In 1998, to offset shoreland development, improve and maintain lake water quality, and protect an environmentally sensitive area, the Green Lake Conservancy Foundation, Inc. (GLCF) and the Green Lake Sanitary District (GLSD), with the support of a state grant, acquired the NBW property to preserve it in perpetuity. The acronym "NBW" is used to describe the property held in trust by the Green Lake Sanitary District and constitutes the study area in this report. The

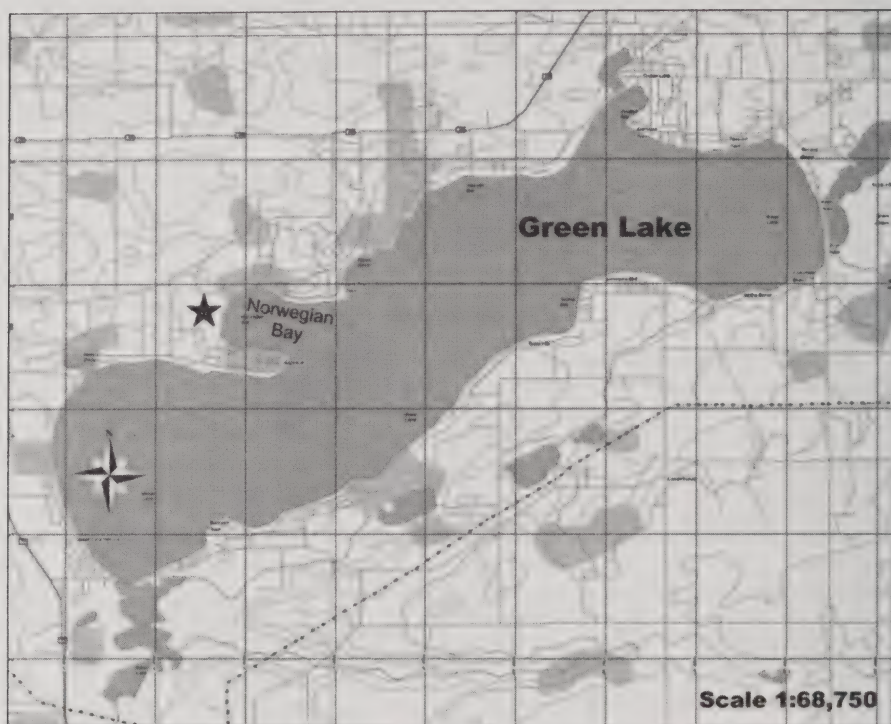


FIGURE 1. Norwegian Bay Wetlands (star) (DeLorme 19999)

NBW encompasses 20.5 acres, including nearly 700 feet of lake frontage. Additional wetlands are contiguous north and south of the property.

Adding to its high-quality natural communities and ecological significance, the NBW is vital because it constitutes the largest wetlands remnant bordering Green Lake and it serves as a Wisconsin Department of Natural Resources (WDNR) "reference site." According to the WDNR, identification and inventory of native shorelands are essential for subsequent shoreland restoration efforts that include plantings of species known to be part of the local native flora. To date, about 60 such restoration projects have occurred on Green Lake shores as part of the Green Lake Association's (GLA) Revitalization of Shoreland Vegetation Project (Lisa Reas, personal communication, 27 August 2001).

LOCATION, GEOLOGY, SOILS, WATER

The NBW is located in Wisconsin's Central Plain region at $N43^{\circ}48.6'$ latitude and $W89^{\circ}2.5'$ longitude in the NW $\frac{1}{4}$ SW $\frac{1}{4}$ section 35, T16N, R12E of Brooklyn Township. Cambrian sandstone is the upper bedrock unit throughout Green Lake Valley, while the surrounding uplands are capped with Ordovician

TABLE 1: Average water quality measurements of spring stream at NBW

Temperature	12.7°Celsius
pH	7.8
Conductivity	250.9 mg/L
Turbidity	34.7 NTU (nephelometric turbidity units)
Flow Rate	0.084 m/sec
Dissolved O ₂	7.0 mg/L
Ammonium (NH ₄ ⁺)	7.1 mg/L
Nitrate (NO ₃ ⁻)	10.7 mg/L
Calcium (Ca ⁺²)	3.1 mg/L
Chloride (Cl ⁻¹)	11.7 mg/L

units of St. Peter sandstone and Prairie du Chien dolomite, respectively (Martin 1965).

Green Lake formed in an ancient preglacial river valley that became dammed by recessional moraines deposited during the Woodfordian stage, 12,000–23,000 years before present (B. P.). The Woodfordian drift, in turn, is covered by glacio-lacustrine sediments deposited by Glacial Lake Oshkosh during the Valdres stage, 6,000–12,000 years B. P. (Paull & Paull 1977). The NBW are situated on the extinct lakebed, below the eastern edge of the recessional moraines.

Soils of the NBW include mostly Houghton muck, with smaller areas of loamy sands and gravels also present. The nearly level and often saturated Houghton muck is derived from lacustrine deposits and oxidized plant material. Besides functioning as a natural buffer that filters, absorbs and stores surface runoff, the organic soils are invaluable for supporting a rich wetlands biota.

An unnamed spring-fed stream, which does not appear on the Princeton East quadrangle map, flows from the northwest property boundary and drains east into a shallow inlet. The thread-like rivulet meanders from west to east through buckthorn thickets, a rich fen assemblage and calcareous meadows. Average water quality measurements near the mouth of the flowage, collected with a CBL (calculator-based laboratory) system in May and August 2001, indicate the stream is of average to above average water quality (Table 1).

ORIGINAL LAND SURVEY RECORDS

The earliest known reports that contain references of specific plants from the NBW area are from the field notes of the original land surveys (General Land Office, 1834 and 1835). The survey records for Township 15 North and Range 12 East were begun on December 26, 1834 and finished January 3, 1835, while surveys for Township 16 North and Range 12 East were begun January 6, 1835 and completed January 15, 1835. A resurvey of the south boundary of T16N was certified on January 3, 1891.

The present-day vegetation patterns for the NBW and adjoining sections correspond closely to the specific names of “witness” trees cited in the original land survey records. Oak forest and savanna were prevalent communities that sur-

rounded the wetlands on Norwegian Bay and were sustained by periodic fires. Trees of the forest and savanna that are frequently reported along town and range lines in the field notes include black, white and bur oak, *Quercus velutina*, *Q. alba* and *Q. macrocarpa*, respectively. Since the records do not consistently cite distances between trees, it is possible that areas mapped oak forest may have actually been oak opening (Finley 1976).

Off the southwest corner of the bay, along the north shore of Sugar Loaf (Sections 1, 2, 3 T15N R12E), the oak forests and openings gathered along the Norwegian Bay shore: "North Between sections 35 & 36 Green Lake Blk Oak on margin of Lake By trigonometry bay of lake 39.88 [chains] wide [equivalent to 0.4985 miles]." Near the quarter section post between sections 35 and 36 the field notes explain: "fell in line north of Lake [at 42.26 chains] Blk Oak 7 [7 inches diameter] on margin of Lake North side." Continuing north on this section line, "W Oak 12" and at the post corner sections, white oak and bur oak are cited as bearing trees and the "Land rolling second rate Blk W & Bur Oak."

North between sections 34 and 35, white and black oak are named at the quarter section post, and at the corner posts of sections 26, 27, 34 and 35 the land is again described as "... rolling second rate Blk W and Bur Oak." Then, north between sections 26 and 35, white oak is a bearing tree at the quarter section post: "W Oak 18 [18 inches diameter] Do 12 [ditto, 12 inches diameter]", while 6.67 chains further west, "Bur Oak 17" is reported. In contrast to the presence of oak forest and savanna contiguous with the NBW on the north and west, bearing trees reported in the field notes indicate a subtle transition to mesic forest to the south, i.e. Sugar Loaf. Between sections 1 and 2 of T15N R12E, from the town line between sections 35 and 36 of T16N R12E: "W Oak 16 Iron wood [ironwood, *Ostrya virginiana*]." Then, 13.85 chains further south between the same sections, a post is set on Green Lake, with red cedar (*Juniperus virginiana*) noted and the "Land rolling second rate Oak Lynn [basswood, *Tilia americana*] Iron wood Cedars."

Similarly, south between sections 2 and 3, T15N R12E, "From post on Town line comes sections 34 & 35 T16N R12E," white oak and black oak are present. Five chains and 3 links further south, "Lynn 8 [*Tilia americana*, 8 inches diameter] on margin of Green Lake between sections 2 & 3." The presence of *Tilia* and *Ostrya* as bearing trees is understandable, given the fact that the range lines immediately south of sections 35 and 36 of T16N R12E mark the north face slope of Sugar Loaf, a prominent dolomitic-capped peninsula that borders the southern shore of Norwegian Bay.

Ironically, nowhere do the original field notes refer to wetlands within the NBW study area. The omission may be attributed to the fact that the study area is not located along the range and township section lines.

PLANT COMMUNITIES

According to the county wetlands GIS polygon, the entire wetlands area of Norwegian Bay is 67.03 acres, or 53%, of the total wetlands on Green Lake (126



FIGURE 2. GIS aerial map depicting wetlands at Norwegian Bay (lightened area) (Wisconsin Department of Natural Resources 1998). The entire area is classified as S3K wetlands (scrub/shrub, broad-leaved deciduous, wet soil, palustrine), based on the WDNR's classification system for wetlands inventory (WDNR 1992).

acres) (WDNR 1998). Of this, the study site comprises 20.5 acres, or 30.5% of the Norwegian Bay wetlands (Fig. 2). The land is classed as S3K wetlands (scrub/shrub, broad-leaved deciduous, wet soil, palustrine), based on the WDNR's classification system for wetlands inventory (WDNR 1992). By comparison, the second-largest wetlands remnant on Green Lake, 18.25 acres, is located on Blackbird Point, east of Dodge County Park on the southwest shore of the main body of Green Lake.

Among the plant communities to occur at the NBW are marsh, shrub-carr, sedge meadow, low prairie, and fen (Fig. 3). Additionally, a low wood on the southwest boundary off Bay Road contains *Populus tremuloides*, *P. deltoides*, and *Juniperus virginiana*. Unfortunately, crowded thickets of *Rhamnus cathartica* and *R. frangula* flourish beneath the canopy. West from here, a small oak wood at higher elevation contains a scattering of *Prunus serotina*, *Quercus alba* and *Q. velutina*.

Pockets of emergent marsh, especially near the lakeshore, are occupied by dense colonies of *Typha angustifolia* and *T. latifolia*, with lesser amounts of *Sparganium eurycarpum* present. *Phalaris arundinacea*, is common, as is *Phrag-*

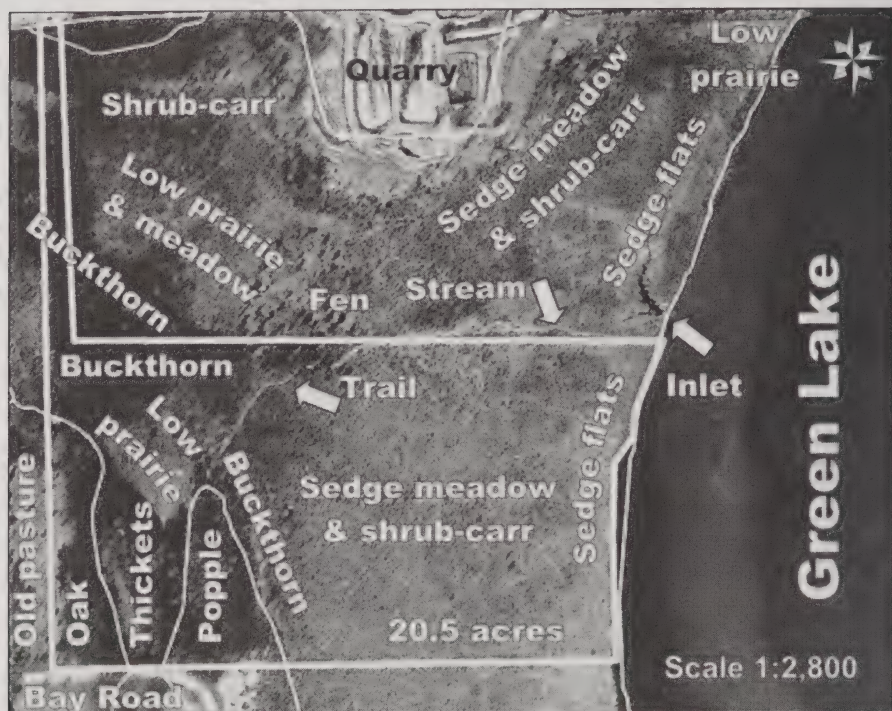


FIGURE 3. GIS aerial map depicting general vegetation patterns for Norwegian Bay Wetlands (20.5 acres) and bordering lands (Wisconsin Department of Natural Resources 1998). Thin lines are soil type contours, while property boundaries are denoted by thick lines. Note the original shoreline, which appears as a lightened area offshore, on the right side of the photograph.

mites australis, which forms a monotypic stand beside a man-made trail near the northeast boundary. Other common emergent aquatic species present include *Equisetum fluviatile*, *Sagittaria cuneata* and *S. latifolia*, *Cicuta bulbifera*, *Aster puniceus*, *Polygonum amphibium*, *Bohemeria cylindrica*, *Cyperus strigosus*, *Eleocharis palustris*, and *Scirpus atrovirens*.

Calcareous sedge meadow occupies the greatest area of the NBW. *Carex stricta* is prevalent, while *C. hystericina*, *C. lacustris* and *C. lasiocarpa* are among the common carices. Characteristic forbs include *Cicuta maculata*, *Oxypholis rigidior*, *Sium suave*, *Bidens* species, *Cirsium muticum*, *Erigeron philadelphicus*, *Eupatorium maculatum*, *Solidago uliginosa*, *Campanula aparinoides*, *Scutellaria galericulata*, *Lysimachia quadriflora* and *L. thyrsiflora*, *Geum alep-picum*, *Agalinis purpurea*, *Pedicularis lanceolata*, and *Verbena hastata*.

Liparis loeselii, one of two orchids known from the NBW, is rare among sedge tussocks, while *Spiranthes cernua* is locally common. *Viola nephrophylla*, an early flowering violet of wet, cold soils, is likewise very local, as is *Apios americana*, which vines along portions of the lakeshore.

Sedge flats along the shoreline are less hummocky and form bog-like mats.

Distinctive *Carex* on these quaking shoreland flats, but not restricted to them, include *C. buxbaumii*, *C. leptalea*, *C. limosa* and *C. vesicaria*. Other sedges include *Eriophorum polystachion* and *Eleocharis acicularis*. The grasses *Leersia oryzoides* and *Muhlenbergia racemosa* are interspersed among the sedges.

Two other species that grow on the sedge flats are *Cyperus diandrus*, an uncommon shoreland plant, and *Menyanthes trifoliata*, a circumboreal plant of sphagnum bogs and wet coniferous forests. Even though *M. trifoliata* is present, characteristic bog ericads were not observed. Prior to this study, the occurrence of *M. trifoliata* in Green Lake County was known only from a University of Wisconsin-Madison (WIS) voucher that was collected near White River Marsh in 1956, while *Cyperus diandrus* was collected in "Drying mud, shore of L. Marion" [Lake Maria, Manchester Township] in 1931 (Theodore C. Cochrane, personal communications, 4 September & 23 October 2001).

Fire suppression accounts for the sustained invasion and ongoing succession of meadow to shrub-carr. *Cornus sericea* and *Salix* spp. are most prevalent throughout, while *Larix laricina*, *Toxicodendron vernix*, and *Betula glandulosa* are more local. *Rhamnus frangula* is spreading, and except for an occasional deer trail, is impenetrable along sections of the trail and spring stream where past disturbances occurred. Indeed, a "buckthorn swamp" surrounds the spring stream along the western boundary. Like *R. frangula*, *Lythrum salicaria* is spreading throughout the NBW, but it is most prominent beside the trail nearest the lakeshore.

Sedge meadow blends into low prairie where grasses are dominant. Prairie along the northwest property boundary is represented by *Calamagrostis canadensis* and *C. stricta*, *Muhlenbergia* spp., *Glyceria striata*, and *Andropogon gerardii*. *Hierochloa odorata* grows intermittently, while *Spartina pectinatus* is typical in wet prairie areas.

Springy, calcareous soils are characteristic of fen, a tie-in between low prairie and sedge meadow. Fen-indicator species occur in calcareous meadows, but their greatest frequencies occur in a fen that lies parallel to the trail and borders the spring stream that flows east. Among the calciphiles known from this assemblage are *Aster umbellatus*, *Gentianopsis procera*, *Lobelia kalmii*, *Parnassia glauca*, *Potentialla fruticosa*, *Solidago riddellii* and *Spiranthes cernua*. A state threatened lily, *Tofieldia glutinosa*, is a rare spring-flowering calciphile that was also documented from this fen.

Wave action and shoreline erosion aid seed dispersal and germination of *Echinochloa walteri* and *Polygonum lapathifolium*, common annual natives that grow on muddy shoreland soils. *Lysimachia vulgaris*, a county record during this study, is an escaped garden perennial that is established near the mouth of the spring stream. The plant was likely introduced as seed, transported by water from a nearby lakeshore property.

Offshore, efforts by the GLSD have been undertaken to protect and propagate a relict stand of *Scirpus acutus*. In the same area, submergents include *Potamogeton* spp., *Vallisneria americana*, *Zosterella dubia*, *Elodea canadensis*, and *Zannichellia palustris*.

LAND USE AND CHANGES IN VEGETATION

Five factors, based in part on anecdotal information, have contributed to changes in the NBW vegetation since the time of European settlement, circa 1835: 1) dam construction, 2) fire suppression, 3) the use of wetlands for pasturage, 4) shoreland development, and 5) the introduction of invasive weeds.

Anson Dart and Smith Fowler constructed the earliest dam in 1845 by impounding the Puchyan River, Green Lake's main outlet (Heiple & Heiple 1976). Initially the raised water levels were used to power a sawmill, then later a gristmill. Eventually, regulation of lake water levels accommodated lakeshore property owners by improving access to piers and recreational boating. The artificially elevated water levels flooded shorelines and adversely impacted shoreland vegetation. Historically, lake levels fluctuated between seasonal drawdowns and flooding, thus allowing for effective seed dispersal and germination. However, after the dam was built, seed reproduction by *Scirpus acutus* and other littoral emergents was diminished.

In the early 1960s, duck hunters anchored a camouflaged houseboat amid the bulrush (Danny Stoneberg, personal communication, 16 September 2001). At that time there were three main stands of hardstem bulrush that covered a larger area and were considerably denser than the present-day stand (Fig. 4). During the 1970s the bulrush beds were sufficiently dense to easily conceal one, maybe



FIGURE 4. Norwegian Bay Wetlands. Note the narrow line of hardstem bulrush, *Scirpus acutus*, in the background. Sugar Loaf, a prominent dolomitic-capped peninsula that borders the southern shore of Norwegian Bay, appears on the right in the background. Photo by the author, 2 September 2000.

two pontoon boats (Steve Lewis, personal communication, 27 August 2001). Presently, about one-quarter of the original bulrush area survives (Kenny Berger, personal communication, 16 September 2001).

Before European settlement, recurring drought and fire were natural features of the oak savanna landscape. However, since the late 1940s, and probably much earlier, fire has been suppressed at the NBW (Chuck Dahlke, personal communication, 27 August 2001). Marsh, sedge meadow, low prairie, and fen are fire-dependent communities that require periodic burning to recycle nutrients and stimulate growth, arrest invasive weeds, and check woody succession. Land use and development surrounding the NBW area by the mid-1900s was more than enough to discourage a managed burn during a dry year—Chuck Dahlke (personal communication, 27 August 2001) recalls a dry year in the early 1950s. While leading cattle from the NBW back to the family farm, he was able to walk down to the lakeshore without getting his feet wet.

The use of the NBW for pasture had a profound impact on the character of the vegetation over time. Soils on the better-drained portions of the property became compacted by grazing herds and the disturbance created ideal conditions for weeds to become established. Aside from helping prune back woody growth where forage was accessible, the continuous grazing probably favored some species over others, and eventually may even have extirpated certain native plants on the property. From 1952 to 1955, Holstein heifers grazed the NBW, but the wetlands served as pasturage for many years even prior to Dahlke ownership (Chuck Dahlke & Anita Dahlke, personal communications, 27 & 28 August 2001).

To create greater access to pasture, a drainage ditch was hand-dug along the southern boundary to partially drain the wetlands (Steve Lewis, personal communication, 2 September 2001). After 1955, the property was no longer used as grazing land and the disturbed areas became overgrown with brush soon after. The property has since been used as recreational land, notably for whitetail deer and duck hunting.

Shoreland development accelerated in Norwegian Bay in the late 1950s. By the mid-1960s, wetlands dredging in the southwest corner of the bay produced a boat canal and generated further interest in development of shoreland properties. The wakes created by increased boating activity continue to contribute to shoreland erosion, and propeller turbulence in shallow areas can cause littoral plants to become uprooted.

In the early 1950s, a sewage treatment plant was constructed northeast of the NBW on the grounds of the American Baptist Assembly. The treated effluent may have benefited wild celery, *Vallisneria americana* (Danny Stoneberg, personal communication, 16 September 2001). Stoneberg noted dense colonies of flowering *Vallisneria* growing near the mouth of the discharge stream, which he suggested was due partly to the increased nutrients from the treated effluent.

When the property was acquired from the Dahlke family in 1992, the land was “very brushy” and in 1994, a trail was established that leads northeasterly off Bay Road to a permanent duck blind on the lakeshore (Steve Lewis, personal communication, 27 August 2001). A major invasion of glossy buckthorn, *Rhamnus frangula*, is evident, but the densest thickets border the trail and the spring stream on the western half of the property. Near the trailhead off Bay Road, R.

frangula is joined by European buckthorn, *R. cathartica*, and Bella honeysuckle, *Lonicera xbella*, two more non-native invasive shrubs. On the opposite end of the trail, large patches of purple loosestrife, *Lythrum salicaria*, are established on both sides of the wooden walkway.

The GLSD and GLCF recognize the need to control the spread of these invasive exotics. The organizations are committed to a management plan that provides the resources and manpower to safely eradicate these ubiquitous weeds, while at the same time protecting and fostering the native vegetation cover.

METHODOLOGY AND CATALOG DESIGN

The catalog of species is based upon plant collections obtained during the 2000 and 2001 growing seasons. Most of the plants listed in the catalog are native, but non-native "naturalized" species are included, as well as cultivars that may have escaped and reproduce spontaneously. In addition to wetlands, roadside collections off Bay Road include upland prairie species and common roadside weeds. Voucher specimens and duplicates were identified and deposited in the University of Wisconsin-Oshkosh Herbarium (OSH). Plant families in the catalog are alphabetized within the major plant groups, as are the genera and species within a family. Nomenclature follows Gleason & Cronquist (1991). The treatment of narrowly defined species and most infraspecific taxa is avoided, as is the listing of synonyms.

Collection numbers that are cited are my own, except for 13 specimens vouchered by my students, and are deposited at OSH. Plants collected and identified during this study that are not included in the published county flora (Eddy 1996) are reported as county records.

One state threatened species, *Tofieldia glutinosa*, was found to occur at the NBW. The threatened status of this rare lily is based on the WDNR's threatened and endangered species list, which was last revised in June 1998 (WDNR 1999). Two additional species, *Calamagrostis stricta* and *Gentianopsis procera*, are listed as special concern, because statewide they show "some problems of abundance or distribution . . ." (WDNR 1999).

COUNTY RECORDS AND SUMMARY OF TAXA

The majority of species compiled for the NBW flora are included as part of the Green Lake County vascular flora (Eddy 1996, 1999). Nonetheless, seven species previously unreported for the county until collected for this study are: *Utricularia intermedia*, *Lysimachia vulgaris*, *Potentilla intermedia*, *Viola nephrophylla*, *V. selkirkii*, *Carex vesicaria*, and *Poa glauca*.

At present, the number of documented vascular plants at the NBW is 248 species (Table 2). This represents 26% of the total county flora (958 species) (Eddy 1996, 1999). A summary of the number of families, genera, and species

TABLE 2. Summaries of Major Plant Taxa at NBW

PLANT GROUP	Families	Genera	Species
Pteridophytes	4	5	8
Gymnosperms	2	2	2
Dicotyledons	50	105	152
Monocotyledons	15	45	86
TOTALS	71	157	248

TABLE 3. A Comparison of the Three Largest Dicot¹ and Monocot Families

DICOTS	Genera	Species	% of total NBW flora
Asteraceae	19	31	12.5%
Rosaceae	7	10	4%
Lamiaceae	7	8	3.2%
MONOCOTS			
Cyperaceae	6	32	12.9%
Poaceae	21	28	11.3%
Potamogetonaceae	1	6	2.4%
TOTALS	61	115	46.3%

¹The Lamiaceae and Polygonaceae are each represented by eight species.

for the three largest dicot and three largest monocot families is compiled in Table 3.

A single family, the Asteraceae, represents about one-fifth or 20.4% of the total number of dicots, while the Poaceae and Cyperaceae together account for 69.8% of the total number of monocots. The combined number of species of the three largest dicot and monocot families comprises 46.3% of the total NBW flora (Table 3).

CATALOG OF SPECIES

PTERIDOPHYTES

EQUISETACEAE

- Equisetum arvense* L. (Eddy 4872; Eddy & Ellis 4752)
E. fluviatile L. (Eddy 4818, 4872; Eddy & Ellis 4741, 4756)

ASPLENIACEAE

- Dryopteris cristata* (L.) A. Gray (Eddy 4871, 4882, 4978)
D. intermedia (Muhl.) A. Gray (Eddy 4976)
Thelypteris palustris Schott var. *pubescens* (Lawson) Fern. (Eddy & Ellis 4772)

ONOCLEACEAE

- Onoclea sensibilis* L. (Eddy & Ellis 4803)

OSMUNDACEAE

- Osmunda cinnamomea* L. (Eddy 4833)

O. regalis L. var. *spectabilis* (Willd.) A. Gray (Eddy & Ellis 4714, 4715)

GYMNOSPERMS

CUPRESSACEAE

Juniperus virginiana L. (Eddy 4824, 4895; Eddy & Ellis 4737)

PINACEAE

Larix laricina (Du Roi) K. Koch (Eddy & Ellis 4774, 4939)

DICOTYLEDONS

ACERACEAE

Acer negundo L. (Eddy 4878; Eddy & Ellis 4958)

AMARANTHACEAE

Amaranthus tuberculatus (Moq.) Sauer (Eddy & Harriman 5049)

ANACARDIACEAE

Toxicodendron vernix (L.) Kuntze (Eddy & Ellis 4964)

APIACEAE

Angelica atropurpurea L. (Eddy 4849)

Cicuta bulbifera L. (Eddy 5005; Eddy & Ellis 4810)

C. maculata L. (Eddy 4993)

Pastinaca sativa L. (Eddy 4910)

Sium suave Walter (Eddy 5017; Eddy & Ellis 4782)

Zizia aurea (L.) Koch (Eddy 4816; K. Valasek 027)

APOCYNACEAE

Apocynum sibiricum Jacq. (Eddy & Neil 4921)

ASCLEPIADACEAE

Asclepias incarnata L. (Eddy & Ellis 4730, 4944)

A. syriaca L. (Eddy & Ellis 4957)

A. tuberosa L. (Eddy 4994)

ASTERACEAE

Achillea millefolium L. (Eddy 4906)

Ambrosia artemisiifolia L. (Eddy 5020)

Aster borealis Prov. (Eddy & Ellis 4723, 4780, 4807)

A. lateriflorus (L.) Britton (Eddy & Ellis 4765, 4785)

A. novae-angliae L. (Eddy 5072)

A. puniceus L. (Eddy & Ellis 4802)

A. umbellatus Miller (Eddy 5014; Eddy & Ellis 4728, 4784)

Bidens cernua L. (Eddy 5062)

B. coronata (L.) Britton (Eddy 5028; Eddy & Ellis 4790)

B. frondosa L. (Eddy 5040; Eddy & Ellis 4755)

Chrysanthemum leucanthemum L. (N. Ellis 011)

Cirsium muticum Michx. (Eddy & Ellis 4758 uncommon white form; Eddy & Ellis 4773 typical pink form)

Erechtites hieracifolia (L.) Raf. (Eddy 5037)

Erigeron philadelphicus L. (Eddy 4831; Eddy & Ellis 4713; N. Ellis 011)

Eupatorium maculatum L. (Eddy 4989; Eddy & Ellis 4770)

E. perfoliatum L. (Eddy 4980; Eddy & Ellis 4776)

E. rugosum Houttuyn (Eddy 5071)

Helianthus giganteus L. (Eddy 5012, 5073)

H. hirsutus Raf. (Eddy & Ellis 4930)

Heliopsis helianthoides (L.) Sweet (Eddy 5013)

- Hieracium caespitosum* Dumort. (Eddy 4905)
Krigia biflora (Walter) S. F. Blake (Eddy 4889; Eddy & Ellis 4719)
Matricaria matricarioides (Less.) Porter (Eddy 4912)
Rudbeckia hirta L. (Eddy & Ellis 4761, 4963)
Solidago canadensis L. var. *canadensis* (Eddy 4979; Eddy & Ellis 4740)
S. riddellii Frank. (Eddy & Ellis 4783)
S. rigida L. var. *rigida* (Eddy 5031)
S. uliginosa Nutt. (Eddy 5030; Eddy & Ellis 4781)
Sonchus oleraceus L. (Eddy & Harriman 5050)
Taraxacum officinale Weber (Eddy 5019)
Tragopogon pratensis L. (Eddy 5018)

BALSAMINACEAE

- Impatiens capensis* Meerb. (Eddy & Ellis 4771, 4973)

BERBERIDACEAE

- Berberis thunbergii* DC. (Eddy 4870)
Podophyllum peltatum L. (Eddy 4868)

BETULACEAE

- Betula glandulosa* Michx. (Eddy & Ellis 4775; Eddy & Harriman 5059)
B. papyrifera Marshall (Eddy & Ellis 4736, 4762)

BORAGINACEAE

- Myosotis scorpioides* L. (Eddy & Neil 4919)

BRASSICACEAE

- Cardamine rhomboidea* (Pers.) DC. (C. Carroll 021; Eddy 4856)
Lepidium densiflorum Schrader (Eddy 4913)

CAMPANULACEAE

- Campanula aparinoides* Pursh (Eddy & Ellis 4727)
Lobelia kalmii L. (Eddy & Ellis 4764)
L. siphilitica L. (Eddy 5070)
L. spicata Lam. var. *spicata* (Eddy 4996; Eddy & Ellis 4968)

CAPRIFOLIACEAE

- Lonicera xbella* Zabel (Eddy 4832; N. Ellis 010)

CAROPHYLLACEAE

- Saponaria officinalis* L. (Eddy & Ellis 4949)

CERATOPHYLLACEAE

- Ceratophyllum demersum* L. (Eddy & Neil 4920)

CLUSIACEAE

- Hypericum perforatum* Lam. (Eddy & Ellis 4948)

CONVOLVULACEAE

- Convolvulus arvensis* L. (Eddy 4886)

CORNACEAE

- Cornus sericea* L. (Eddy 4814; Eddy & Ellis 4796)

EUPHORBIACEAE

- Acalypha rhomboidea* Raf. (Eddy 5036)

FABACEAE

- Apios americana* Medikus (Eddy & Ellis 4749; Eddy & Harriman 5060)
Lathyrus palustris L. (Eddy 4843; Eddy & Ellis 4689, 4961)

- Medicago lupulina* L. (Eddy 4902; Eddy & Ellis 4908)
Melilotus alba Medikus (Eddy & Ellis 4950)
M. officinalis (L.) Pallas (Eddy 4909)
Trifolium pratense L. (Eddy 4995)
T. repens L. (Eddy 4911)

FAGACEAE

- Quercus alba* L. (Eddy 4877)
Q. velutina Lam. (Eddy 4879)

GENTIANACEAE

- Gentiana andrewsii* Griseb. (Eddy 5025; Eddy & Ellis 4805)
Gentianopsis procera (Holm.) Ma STATE SPECIAL CONCERN (Eddy & Ellis 4778)

GERANIACEAE

- Geranium maculatum* L. (Eddy 4875)

LAMIACEAE

- Lycopus americanus* Muhl. (Eddy 5003; Eddy & Ellis 4724, 4950)
L. uniflorus Michx. (Eddy 5043)
Mentha arvensis L. var. *canadensis* Kuntze (Eddy 5068)
Monarda fistulosa L. (Eddy & Ellis 4956)
Prunella vulgaris L. (Eddy & Ellis 4955)
Pycnanthemum virginianum (L.) Durand & B. D. Jackson (Eddy 4839, 4983; Eddy & Ellis 4766)
Scutellaria galericulata L. (Eddy 4982, 5001; Eddy & Ellis 4742, 4936, 4947)
Teucrium canadense L. var. *occidentale* (A. Gray) McClintock & Epling (Eddy 5011; Eddy & Ellis 4811)

LENTIBULARIACEAE

- Utricularia intermedia* Hayne (Eddy & Neil 4928) COUNTY RECORD
U. vulgaris L. (Eddy 4838; Eddy & Ellis 4800)

LYTHRACEAE

- Lythrum alatum* Pursh (Eddy & Ellis 4945)
L. salicaria L. (Eddy & Ellis 4738)

MENYANTHACEAE

- Menyanthes trifoliata* L. (Eddy 4846; Eddy & Ellis 4793)

MONOTROPACEAE

- Monotropa uniflora* L. (Eddy 5000)

NYMPHAEACEAE

- Nuphar variegata* Durand (Eddy 5064)

ONAGRACEAE

- Circaea lutetiana* L. (Eddy & Ellis 4967)
Epilobium ciliatum L. (Eddy 5039; Eddy & Ellis 4760)

OXALIDACEAE

- Oxalis stricta* L. (Eddy 5035)

PLANTAGINACEAE

- Plantago rugelii* Decne. (Eddy 4914, 4997)

POLEMONIACEAE

- Phlox pilosa* L. (Eddy 4823; Eddy & Ellis 4690)

POLYGONACEAE

- Polygonum amphibium* L. (Eddy & Ellis 4744, 4750, 4941; Eddy & Harriman 5047; Eddy & Neil 4918)
P. aviculare L. (Eddy 4985)
P. lapathifolium L. (Eddy & Ellis 4745; Eddy & Harriman 5047)
P. persicaria L. (Eddy & Ellis 4763)
P. punctatum Elliott var. *punctatum* (Eddy 4990; Eddy & Ellis 4759)
Rumex acetosella L. (Eddy & Ellis 4720)
R. crispus L. (Eddy 4904)
R. orbiculatus A. Gray (Eddy 5006; Eddy & Ellis 4801)

PRIMULACEAE

- Lysimachia quadriflora* Sims. (Eddy & Ellis 4743; Eddy & Neil 4931)
L. thyrsoiflora L. (Eddy 4842; Eddy & Ellis 4688)
L. vulgaris L. (Eddy & Neil 4929) COUNTY RECORD

RANUNCULACEAE

- Anenome canadensis* L. (Eddy & Neil 4934)
A. quinquefolia L. (K. Valasek 028)
Caltha palustris L. (C. Carroll 024)
Ranunculus longirostris Godron. (Eddy & Neil 4935)
R. pensylvanicus L. f. (Eddy 4975)
R. recurvatus Poiret (Eddy 4821)

RHAMNACEAE

- Rhamnus cathartica* L. (Eddy 5038; Eddy & Ellis 4804)
R. frangula L. (Eddy & Ellis 4739)

ROSACEAE

- Fragaria virginiana* Duchesne (Eddy 4853)
Geum aleppicum Jacq. var. *strictum* (Aiton) Fern. (Eddy 4894; Eddy & Ellis 4946)
G. canadense Jacq. (Eddy 4971)
Potentilla fruticosa L. (Eddy & Ellis 4701, 4779)
P. intermedia L. (Eddy 4888) COUNTY RECORD
P. simplex Michx. (Eddy & Ellis 4712)
Prunus serotina Ehrh. (Eddy 4880)
Pyrus malus L. (Eddy 4881)
Rosa palustris Marshall (Eddy & Ellis 4953)
Spiraea tomentosa L. (Eddy 5004)

RUBIACEAE

- Galium boreale* L. (Eddy & Ellis 4704)
G. labradoricum (Wieg.) Wieg. (C. Carroll 025; Eddy 4857)

SALICACEAE

- Populus deltoides* Marshall (Eddy 4900; Eddy & Ellis 4951)
P. tremuloides Michx. (Eddy & Ellis 4970)
Salix bebbiana Sargent (Eddy 4865; Eddy & Ellis 4747)
S. candida Fluegge (Eddy 4866; Eddy & Ellis 4681, 4746)
S. exigua Nutt. (Eddy & Ellis 4952)
S. fragilis L. (Eddy 5063)
S. pedicellaris Pursh (Eddy 4817)

SAXIFRAGACEAE

- Parnassia glauca* Raf. (Eddy & Ellis 4729)

SCROPHULARIACEAE

- Agalinis purpurea* (L.) Pennell var. *parviflora* (Benth.) B. Boivin (Eddy & Ellis 4733, 4777)
Chelone glabra L. (Eddy 5024, 5056; Eddy & Ellis 4722)

- Pedicularis lanceolata* Michx. (Eddy 5015; Eddy & Ellis 4767; Eddy & Neil 4932)
Penthorum sedoides L. (Eddy 5008)
Verbascum thapsus L. (Eddy 4992)
Veronica officinalis L. (Eddy 4890; Eddy & Ellis 4716, 4717)

SOLANACEAE

- Solanum dulcamara* L. (Eddy & Ellis 4685)

TILIACEAE

- Tilia americana* L. (Eddy 5016)

ULMACEAE

- Ulmus americana* L. (Eddy 4841, 4901; Eddy & Ellis 4962)

URTICACEAE

- Bohemeria cylindrica* (L.) Swartz (Eddy & Ellis 4787, 4960)
Pilea pumila (L.) A. Gray (Eddy & Ellis 4757)
Urtica dioica L. var. *procera* (Muhl.) Wedd. (Eddy & Ellis 4795)

VERBENACEAE

- Verbena hastata* L. (Eddy & Ellis 4731, 4954)

VIOLACEAE

- Viola nephrophylla* Greene (Eddy 4854; Eddy & Ellis 4806) COUNTY RECORD
V. selkirkii Pursh (Eddy 4819) COUNTY RECORD
V. sororia Willd. (Eddy 4852)

VITACEAE

- Parthenocissus vitacea* (Knerr) A. Hitch. (Eddy 4876)
Vitis riparia Michx. (Eddy 4915, 5002)

MONOCOTYLEDONS

ALISMATACEAE

- Alisma subcordatum* Raf. (Eddy 4972)
Sagittaria cuneata Sheldon (Eddy 4977)
S. latifolia Willd. (Eddy 5042; Eddy & Harriman 5057)

COMMELINACEAE

- Tradescantia ohiensis* Raf. (Eddy 4903)

CYPERACEAE

- Carex alopecoidea* Tuckerman (C. Carroll 020)
C. buxbaumii Wahlenb. (Eddy 4827, 4862; Eddy & Ellis 4684)
C. bebbii (L. Bailey) Fern. (Eddy 4883, 4974; Eddy & Ellis 4677, 4959)
C. festucacea Schk. (Eddy 4999)
C. foenea Willd. (Eddy 4815, 4834, 4836)
C. hystericina Muhl. (Eddy 4840, 4850; Eddy & Ellis 4707, 4711, 4791)
C. interior L. Bailey (Eddy 4835, 4837, 4860)
C. lacustris Willd. (Eddy 4845; Eddy & Ellis 4683)
C. lasiocarpa Ehrh. (Eddy 4859)
C. leptalea Wahlenb. (Eddy 4812; Eddy & Ellis 4702, 4709, 4799)
C. limosa L. (Eddy 4820)
C. pseudocyperus L. (Eddy & Ellis 4792)
C. rosea Schk. (Eddy 4892; Eddy & Ellis 4675, 4676)
C. sartwellii Dewey. (Eddy & Ellis 4686)
C. stricta Lam. (C. Carroll 023; Eddy 4825, 4848, 4863; Eddy & Ellis 4692)
C. stipata Muhl. (Eddy 4822, 4847, 4867)
C. tetanica Schk. (Eddy 4813, 4828, 4864; Eddy & Ellis 4693, 4710, 4718)

- C. vesicaria* L. (Eddy 4885; Eddy & Ellis 4687) COUNTY RECORD
Cyperus bipartitus Torr. (Eddy & Ellis 4754)
C. diandrus Torr. (Eddy 5066; Eddy & Ellis 4942; Eddy & Harriman 5045)
C. odoratus L. (Eddy 5009)
C. strigosus L. (Eddy 5067)
Eleocharis acicularis (L.) Roemer & Schultes (Eddy 4897)
E. compressa Sullivant (Eddy 4896)
E. intermedia (Muhl.) Schultes (Eddy & Ellis 4678, 4943)
E. palustris L. (Eddy 4851)
Eriophorum polystachion L. (Eddy 4858; Eddy & Ellis 4703)
Rhynchospora capillacea Torr. (Eddy & Ellis 4966)
Scirpus atrovirens Willd. (Eddy 4899; Eddy & Ellis 4700, 4788; Eddy & Neil 4933)
S. cyperinus (L.) Kunth (Eddy 5026)
S. pungens Vahl. var. *longispicatus* (Britton) Cronq. (Eddy & Ellis 4705)
S. acutus Muhl. ex Bigelow (Eddy 4887; Eddy & Ellis 4808)

HYDROCHARITACEAE

- Elodea canadensis* Michx. (Eddy & Neil 4923)
Vallisneria americana L. (Eddy 5010; Eddy & Harriman 5049)

IRIDACEAE

- Iris versicolor* L. (Eddy 4867a; Eddy & Ellis 4682)

JUNCACEAE

- Juncus greenii* Oakes & Tuckerman (Eddy & Ellis 4697, 4937)
J. tenuis Willd. var. *dudleyi* (Wieg.) F. J. Herm. (Eddy 4830)
Luzula multiflora (Retz.) Lej. (Eddy 4891)

LEMNACEAE

- Lemna minor* L. (Eddy & Neil 4920)

LILIACEAE

- Hypoxis hirsuta* (L.) Cov. (Eddy & Ellis 4706; K. Valasek 029)
Tofieldia glutinosa (Michx.) Pers. (Eddy & Ellis 4748) STATE THREATENED

ORCHIDACEAE

- Liparis loeselii* (L.) Rich. (Eddy & Ellis 4725)
Spiranthes cernua (L.) Rich. (Eddy & Ellis 4726; Eddy & Harriman 5041)

POACEAE

- Andropogon gerardii* Vitman. (Eddy 49941; Eddy & Ellis 4769)
Bromus ciliatus L. (Eddy 4893; Eddy & Ellis 4735)
B. inermis Leysser (Eddy 4907)
Calamagrostis canadensis (Michx.) P. Beauv. (Eddy 4873; Eddy & Ellis 4969)
C. stricta (Timm) Koeler (Eddy 4884, 4988) STATE SPECIAL CONCERN
Digitaria ischaemum (Schreber) Muhl. (Eddy 5033)
Echinochloa walteri (Pursh) Heller (Eddy & Ellis 4809; Eddy & Harriman 5044)
Elymus trachycaulus (Link) Gould (Eddy & Ellis 4768)
Elytrigia repens (L.) Nevski. (Eddy 4986; Eddy & Ellis 4965)
Glyceria striata (Lam.) A. Hitch. (Eddy 4829, 4861, 4869; Eddy & Ellis 4691, 4696, 4698)
Hierochloa odorata (L.) P. Beauv. (C. Carroll 021; Eddy 4855; Eddy & Ellis 4680, 4699)
Leersia oryzoides (L.) Swartz (Eddy & Harriman 5048)
Muhlenbergia glomerata (Willd.) Trin. (Eddy & Ellis 4734)
M. mexicana (L.) Trin. (Eddy & Ellis 4721, 4751, 4798)
M. racemosa (Michx.) BSP. (Eddy 4984; Eddy & Ellis 4794)
Panicum capillare L. (Eddy 5046)
P. lanuginosum Elliott var. *septentrionale* Fern. (Eddy 4898, 4981; Eddy & Ellis 4753, 4938)
P. dichotomiflorum Michx. (Eddy 4998)
Phalaris arundinacea L. (Eddy & Ellis 4694; N. Ellis 012)

- Phleum pratense* L. (Eddy 5001)
Phragmites australis (Cav.) Trin. (Eddy 5027; Eddy & Ellis 4789)
Poa glauca Vahl (Eddy & Ellis 4695) COUNTY RECORD
P. pratensis L. (Eddy 4916)
Schizachyrium scoparium (Michx.) Nash var. *scoparium* (Eddy 5029)
Setaria viridis (L.) P. Beauv. (Eddy 4987)
Spartina pectinata Link (Eddy & Ellis 4797)
Sphenopholis obtusata (Michx.) Scribn. var. *major* K. S. Erman. (Eddy 4874)
Sporobolus neglectus Nash (Eddy 5034)

PONTEDERIACEAE

- Zosterella dubia* (Jacq.) Small (Eddy 5022)

POTAMOGETONACEAE

- Potamogeton crispus* L. (Eddy & Neil 4924)
P. filiformis Pers. (Eddy 5021, 5065)
P. friesii Rupr. (Eddy & Neil 4925)
P. gramineus L. (Eddy & Neil 4927)
P. pectinatus L. (Eddy 5069)
P. robbinsii Oakes. (Eddy & Harriman 5048)

SPARGANIACEAE

- Sparganium eurycarpum* Engelm. (Eddy & Neil 4917)

TYPHACEAE

- Typha angustifolia* L. (Eddy & Neil 4922)
T. latifolia L. (Eddy & Ellis 4940)

ZANNICHELLIACEAE

- Zannichellia palustris* L. (Eddy 5023)

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NOTEWORTHY COLLECTIONS

WISCONSIN

TOMANTHERA AURICULATA (Michx.) Raf. (Scrophulariaceae) Eared false foxglove

Previous knowledge. This species was known historically in Wisconsin from three counties: Dane (1858 and 1860); Lafayette (26 August 1888); and Racine (29 August 1892, and 18 August 1900), based on records in MIL, UWM, and WIS. It is apparently rare and local throughout its native range (USDA, NRCS 1999), which extends from Ohio to Minnesota, south to Alabama and Texas. There is some question as to its nativity in the eastern United States. Gleason & Cronquist (1991) considered it to be an introduced species in New Jersey, Pennsylvania, and Virginia. Earlier, Pennell (1928) stated that the species had evidently been introduced into such disturbed habitats as old fields and railroad embankments from New Jersey to Virginia. However, this was amended (Pennell 1935) after early collections from Delaware apparently precluded introduction from the western prairies. Voss (1996) noted that in Michigan it has been collected only in a "sandy bur oak opening" in 1837 and "dry opening" in 1838. It is known from four sites in Minnesota; the collection from Big Stone County 1985 was the first state record in over 25 years (Wheeler et al. 1991). It is known from seven counties in eastern and south-central Iowa, where it is described as "rare" (Eilers & Roosa 1994). Mohlenbrock & Ladd (1978) map it as occurring in 25 counties in Illinois; Swink & Wilhelm (1994) show one additional Illinois county (Kane), plus two counties in northwestern Indiana. It was rediscovered in Ohio in 1985 (Knoop 1988).

Synonyms for *Tomanthera auriculata* include *Gerardia auriculata* Michx. and *Agalinis auriculata* (Michx.) S.F. Blake.

Descriptions of habitat vary, including moist prairies, dry prairies, dry-mesic savanna, old fields, wood borders, and thickets (Swink & Wilhelm 1994); prairies, old fields, or rarely open woodlands (Salamun 1951); shallow drainage-way in degraded prairie pasture (Wheeler et al. 1991); prairies and prairie borders (Read 1974); and moist depressions in prairie remnants (Eilers & Roosa 1994). Cunningham & Parr (1990) note that the species is a hemiparasite.

Significance. *Tomanthera auriculata* is a listed species across much of its range. It is listed as Threatened in Illinois and is on Minnesota's State Endangered List. It is a category 2 species for possible Federal listing as threatened or endangered. The species' global rank is G3: "Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range . . . or because of other factors making it vulnerable throughout its range; in terms of occurrences, in the range of 21 to 100" (Wisconsin Natural Heritage Program 1999). Read (1976) stated "this species is presumed extirpated in Wisconsin," and the Wisconsin Natural Heritage Program (1999) has offi-

cially listed it as such. The two collections reported here document the continued presence of *Tomanthera auriculata* in Wisconsin, and add two new county records. The possibility exists that other populations are present in the southern Kettle Moraine area of southeastern Wisconsin.

Diagnostic characters. This species is an annual, herbaceous dicot, to one meter tall. Leaves are simple, opposite, lanceolate to broadly lanceolate, and scabrous on their upper surfaces. The upper leaves are auricled at the base. The stem is terete and pubescent, with numerous longer, stiff, retrorse hairs. The inflorescence is an interrupted spike, with foliaceous bracts exceeding the flowers. The complete, hypogynous, solitary flowers are found in the bract axils. They are sessile or subsessile, on pedicels no greater than 1 mm. The rose-violet corollas are slightly irregular, about 20–23 mm long, not densely woolly inside. Dark purple spots are found anteriorly. The style is pubescent, and there are 4 fertile stamens. The calyx is retrorse-pubescent, the lobes strongly ascending-scabrous, and the calyx soon becomes at least 1 cm long. The 5 sepals are fused about 1/3 the length of the calyx. The fruit is a broadly ovoid capsule, 10–13 mm long. Seeds are ellipsoid-ovoid, 1.3–1.6 mm long.

Voucher specimens have been deposited at WIS and at the Southeastern Wisconsin Regional Planning Commission, Waukesha, Wisconsin. Color photographs of the species are presented at the web site of the University of Wisconsin-Madison herbarium (www.wisc.edu/botany/herbarium/home.html).

WISCONSIN. WALWORTH COUNTY: Bluff Creek Low Prairie; T4N R15E Section 23; good quality wet-mesic prairie; about 600 stems; corollas rose-violet; 9 September 1999; *Leitner 6657* (WIS).

WISCONSIN. WAUKESHA COUNTY: Paradise Creek Low Prairie; T5N R17E Section 16; mix of wet-mesic prairie and old field; 120–150 individuals; corollas rose-violet; 2 September 1999; *Leitner 6646*.

Ecological Notes: These two stations, about 19 km apart, both lie within the Kettle Moraine region of southeast Wisconsin, a generally north-south trending area of glacial hills, kettle hole depressions, and open wetlands. The station in Waukesha County is located in the large Scuppernong Marsh area. The site, about 0.25 hectare, consists of a mix of low prairie and old field; associated species include *Solidago graminifolia*, *S. rigida*, *Cornus racemosa*, *Pycnanthemum virginianum*, *Helianthus* spp., and *Oxypolis rigidior*. The population consists of about 150 stems, of which about 100 were in flower. It lies adjacent to a wooded fencerow. The prairie was burned by Wisconsin Department of Natural Resources personnel in April, 1999, prior to the species' discovery. Soils consist of the somewhat poorly drained Aztalan silt loam, 2–6% slopes.

The station in Walworth County lies in a low, open area adjacent to Bluff Creek. Vegetation consists of wet-mesic prairie, spread over 6 to 8 hectares. Associated species include *Solidago graminifolia*, *Cornus racemosa*, and *Pycnanthemum virginianum*. The population consists of about 600 plants, of which about 50 were in flower. The site was burned by Wisconsin DNR personnel about 1991, and has been brush-cut on a semi-regular basis since. Soils consist

of Pella silt loam (deep, poorly drained, silty; in depressions and drainageways). Both stations lie within the Kettle Moraine State Forest.

Updates: As a result of the rediscovery of *Tomanthera auriculata* in Wisconsin, its status has been changed by the Wisconsin Natural Heritage Program from "presumed extirpated" to Special Concern (see web page: www.dnr.state.wi.us/org/land/er/rare.htm). Its state rank is now S1: "Critically imperiled in Wisconsin because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extirpation from the state." Surveys in late August of 2000 and 2001 revealed approximately 25 stems in 2000 and 250 stems in 2001 at the Waukesha County station, and approximately 600 stems in 2000 and 450 stems in 2001 at the Walworth County station.

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—Lawrence A. Leitner
Southeastern Wisconsin Regional Planning Commission
P.O. Box 1607
Waukesha, Wisconsin 53187-1607
262. 547. 6721, extension 262; lleitner@sewrpc.org

MULBERRY WEED (*FATOUA VILLOSA*) SPREAD AS FAR NORTH AS MICHIGAN

A.A. Reznicek

University of Michigan Herbarium
3600 Varsity Drive, Suite 112
Ann Arbor, Michigan 48108-2287
reznicek@umich.edu

Mulberry weed, *Fatoua villosa* (Thunb.) Nakai, also known as hairy crab-weed, is a warm temperate annual widespread in Asia and introduced and rapidly spreading in North America. It first appeared in North America in Louisiana, where Thieret (1964) noted "Dr. Joseph Ewan of Tulane University informs me that the plant has been found as a weed in New Orleans for at least 15 years." This implies that it entered North America at least as early as the late 1940s. Thieret comments that "seedlings were frequent on the campus [of the University of Southwestern Louisiana] this past spring, even following the severe winter of 1962–63, when the temperature in LaFayette dropped to 15 degrees F." This suggested, somewhat ominously, that the plant could become weedy over a much larger area than the extreme south. Indeed, it was reported from Florida in 1974 (DuQuesnay 1974) and, by 1975, it had been also found in Alabama, Georgia, Mississippi, and North Carolina (Massey 1975). In 1977, perhaps belatedly, it was listed as an economically important foreign weed that potentially could be a problem in the United States (Reed 1977). The distribution of *Fatoua* as mapped and reported in Flora North America now encompasses all of the southeast, including Texas, and north to Oklahoma, Arkansas, Indiana, Kentucky, Maryland, and West Virginia (Wunderlin 1997). It has also been reported from California (Sanders 1996), Washington (Washington State Noxious Weed Control Board 2001), and is now known from southern Missouri (Yatskievych & Raveill 2001). *Fatoua* has recently also been reported from even closer to Michigan, as Vincent (1993) noted its occurrence in south central Ohio.

Still, it was a surprise to see *Fatoua* in southern Michigan. Stopping at a rest area along I-94 west of Jackson (Jackson County), I noticed *Fatoua* locally abundant in some ornamental plantings surrounding the buildings. In some small areas, the plants were so dense as to be a solid ground cover, and hundreds of plants were present.

Fatoua is becoming a problem weed in containerized nursery stock (Neal, 1998), and it likely is spread widely and rapidly by planting of containerized stock. The Michigan station was not likely a new introduction that year, as it was most frequent in an area of perennial ground cover that had obviously been planted at least several years before and the plant presumably had been building up its population for several years at least to reach such numbers.

Morphologically, *Fatoua villosa* somewhat resembles a seedling white mulberry (*Morus alba* L.). The alternate leaves are roughly similar in arrangement

and overall appearance. They are however, finely hispid, and the general aspect of the plant also strikes one as nettle-like. The axillary flowers are arrayed in greenish to purple-tinged, loose, hemispherical heads, giving an unusual appearance to the plant. Illustrations are found in Wunderlin (1997) and photos on the internet at www.ces.ncsu.edu/depts/hort/weeds/mweed1.html.

Specimen Citation:

MICHIGAN. Jackson Co.: Rest area on S side of I-94 ca. 0.8 mi W of Business 94 exit on west side of Jackson, SE¼ sect. 25, T2S R2W, North Lat. 42° 16' 15" West Long. 84° 25' 40" (from map). Weed in perennial ground cover planting (low junipers) in beds around rest area building, Sept. 25, 2001, A.A. Reznicek et. al. 11300 (MICH, MSC, MU, and numerous duplicates to be distributed).

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REVIEWS

DISTRIBUTION AND HABITAT DESCRIPTIONS OF WISCONSIN LAKE PLANTS. Stanley A. Nichols. 1999. Wisconsin Geological and Natural History Survey, Bulletin 96. xi + 266 pages + two unnumbered pages at the back; metal-ring binding with a sturdy plastic cover. \$15 + \$3.25 postage and handling, available from Wisconsin Geological and Natural History Survey, 3817 Mineral Point Road, Madison, WI 53705. Telephone orders at 608. 262. 1705, with V or MC only. www.uwex.edu/wgnhs/, but no sales via that site.

This is not a taxonomic monograph. The names are simply taken from Gleason & Cronquist, ed. 2, 1991. There are no keys. There are no descriptions. There are 107 species treated, by my rough count, in alphabetical order by Latin name, and nearly all are accompanied by a faithful and well-reproduced draw-

ing. The drawings are by Carol Watkins, whose work is acknowledged on p. 260. They are beautifully done and she deserves thanks and congratulations from botanists.

As the title says, the book intends to document distribution. For each species, there is a distribution map of the state, with asterisks for literature reports believed to be reliable and little black squares for actual herbarium records. I believe the author included only herbarium records where the label indicated the plant was in a lake. Wet-roadside-ditch records appear not to have been included. This results in some really odd omissions, but in fairness to the author the maps should not be looked at uncritically. (At a glance, one might suppose that *Typha latifolia* is missing from much of eastern Wisconsin!) The Great Lakes and the pools of the Upper Mississippi River are also omitted, on the ground that collections are much more difficult to link to specific locational or habitat characteristics.

The first thing that occurred to me when I opened the book was, here's an excellent guide to finding some of the state's floristic oddities. For example, the book shows there are four known occurrences of *Potamogeton pulcher*; I would have said from personal experience that the species doesn't occur in Wisconsin. That opinion would have been re-inforced by the range statement in Gleason & Cronquist, ed. 2, which seems fairly clearly to exclude Wisconsin from the known range. [Voss in Michigan Flora shows only two sites.]

For species abundant enough to yield meaningful data, the author has compiled data on water depth, pH, conductivity, and alkalinity. Substrate preference and turbidity tolerance are also assessed. Flowering and fruiting times (taken from herbarium labels) are also given, though these are doubtless skewed—herbarium curators often discard specimens of Cyperaceae and Juncaceae that are only in flower.

The motive in all this is to permit the framing of hypotheses that can be tested in the field or laboratory. At this stage in the process, the author concludes that "Species having similar habitat requirements are not necessarily found growing together; habitat similarities do not predict species associations very well." One of the problems with this is that what we call habitat "requirements" may be nothing of the sort—they may be tolerance limits. *Cannabis sativa* around here is to be found only in sandy soils, if left to its own devices, but it will grow perfectly well if planted in heavy lakebed clays. It strikes me that the line between "requirements" and "tolerances" has got awfully thin. Or blurred.

Habitat similarities do not predict species associations very well. But what, if anything, do species associations tell us? The process of listing out on herbarium labels the associates of a species has always seemed to me to be a time-consuming and largely pointless exercise. If each species is a uniquely evolved entity, then listing all the species with which it is "associated" at any given site is about as meaningful as specifying all the people whom I shared a plane trip with. Moreover, recognizable associates will vary with the season, and with respect to aquatics they may also vary with water depth, in the sense that in deeper water many species remain vegetative and do not flower. Species associations are sometimes given in this book, but without amplification and certainly

without statistical verification. I *think* these are little more than interesting anecdotes.

“Because the information presented here is open to interpretation, the report does not dwell on interpretation—readers can use the information in ways that fit their needs (p. 1).” I applaud the author’s discretion and caution.

—Neil A. Harriman
Biology Department
University of Wisconsin-Oshkosh
Oshkosh, WI 54901
harriman@uwosh.edu

THE LANDSCAPE REVOLUTION: GARDEN WITH MOTHER NATURE, NOT AGAINST HER. Andy Wasowski with Sally Wasowski. 2000. 166 pages. Contemporary Books, 4255 West Touhy Ave., Lincolnwood (Chicago), Illinois 60646-1975. ISBN: 0-8092-2665-0. U.S. \$27.95.

I have been a “revolutionary” since I bought my house in 1977. Then, however, books like this weren’t available to guide me in my “natural landscaping” endeavors. The Wasowskis have landscaped in many different parts of the U.S. where they have lived. One weakness of a book like this, which attempts to cover the whole United States, is that detail needed for a particular region is sacrificed to be comprehensive.

Wasowski begins by explaining why our current landscapes are harmful to the environment. Anyone who has tried to maintain a perfect green velvet lawn knows the drill: Fertilize (the fertilizer then permeates to the ground water supply and often runs off into nearby lakes and streams causing algae blooms); water extensively (Wasowski describes in detail the world wide water shortage and how a lawn’s “drinking problem” contributes to this); mow, polluting the air (inefficient gasoline mower motors are one the biggest air polluters) and contributing to global warming as well as using time that could be spent more enjoyably doing something else; bag those grass clippings in plastic bags and deliver them to a landfill.

Wasowski differentiates between a “natural” landscape, which he defines as using only “native” plants and a “naturalized” landscape, defined to include with the natives, some “well behaved,” i.e. non-invasive, exotics. His definition of a native plant is one that was germinated and raised within 100 miles of where the landscape is located. This he considers to be the local “provenance” of the species. In western Michigan where I live, however, that may be too extensive a range. Plants that thrive here along the Lake Michigan shoreline often can’t live a mere 15 miles inland and vice versa. The benefits of a natural or naturalized landscape are detailed: The plants are adapted to local natural conditions, so need minimal watering and fertilizing, and hence very little maintenance; local plants have evolved to live on the rainfall available in their provenance, whether

it be Pacific Coast Rain Forest or Arizona desert; the right species can provide food and cover for wildlife, such as favorite bird and butterfly species; alternatives to pesticides, again not usually needed for native plants because they have evolved along with the native predators.

Wasowski offers tips for combating local "weed ordinances." He also details how to convert a typical "cookie cutter" landscape into a natural or naturalized one, step by step. If the homeowner is lucky enough to be starting from scratch, the process is much easier and that too is described. Construction techniques to be used in new developments can be implemented to save existing vegetation when building. Some communities now mandate such practices when issuing building permits. This is one of the more encouraging predictions of this book, along with Wasowski's assertion that by 2035, the landscapes prevalent today will be totally obsolete, replaced by natural plants that will be environmentally friendly. And to think I was a "pioneer" in this movement! I would recommend this and other recent books along similar lines as a starting point for anyone interested in natural landscaping. President Clinton signed into law a bill that has established consortiums of governmental agencies around the country to promote this concept. "Invasive Plants Councils" or "Plants Out Of Place" conferences are the result of this. State Departments of Natural Resources, Soil Conservation Districts, University Cooperative Extension Services, but especially the U. S. Forest Service, are some of the organizations that are usually involved. The public education conferences they sponsor are an excellent source of obtaining further information, especially since they are slanted towards a certain state or geographical region. Developing a natural or naturalized landscape can be a challenge. As more of us move in this direction and request native plants from local nurseries and garden centers, the law of supply and demand will make the process easier. And if we can become active on local planning commissions and governing bodies, such as city councils and county commissions, to revise outdated "weed ordinances," there will be fewer impediments. As the U.S. becomes more accepting of the fact that global warming exists and threatens our very existence, landscapes that diminish the use of power mowers will be viewed with greater favor.

—Betty J. Mattson
Sky Enterprises Nature Education
805 Waverly Ave.
Grand Haven, MI 49417-2131

Pettigrew, J. 1999. *TEA & INFUSIONS. A CONNOISSEUR'S GUIDE*. Carlton Books Limited. Paperback; 96 pp. ISBN 1-85868715-2 \$14.95

The typical American goes into a restaurant and when the waitress asks, "Coffee?" and you say, "No thank you, I would like a cup of tea," you get a sigh, and a blank look in disbelief. A short time later you get a cup and

saucer, and a metal container containing moderately hot water at best and a common brand tea bag on the side. This bag is then steeped in this warm water and to swallow the brew you have to heap two or more teaspoons of sugar into the infusion to make it palatable. It is no wonder Americans prefer Gloria Jean's or Starbucks for their morning caffeine fix, even though tea is the preferred drink by more people in the world today.

Still, the American public is assailed every day in many different ways to drink tea. "Tea is good for you." "Tea will reduce the chances that you will develop certain diseases." "Tea plays a role in human health." Tea, especially green tea has an abundance of polyphenols (also known as flavonoids) that act as antioxidants that prevent or slow down the effects of free radicals, the compounds in the body that cause aging and cell damage. And we all want to be forever young, don't we? But to be young forever do we have to (as a friend once said to me) "loose our taste buds in the process?"

With these things swirling in my head I picked up the large (9 X 12 in.) but thin book (96 pages) by Jane Pettigrew with interest at my local book store. Its blue cover with an orange and green tea cup and saucer and orange slice floating in the brown liquid certainly caught my eye. Opening the book I found 90 color photographs (some full page) well dispersed throughout the seven chapters.

Chapter 1, The Story of Tea, traces the history of *Camellia sinensis* (also called *Thea sinensis*) from its discovery in China in 2737 BC: the English Opium War, the trade that developed between China and surrounding countries, the hated tea tax on the American colonies leading to the American War of Independence, and the spread of tea production to Africa and the New World. It also traces how the use of tea bags came about by accident in 1908 by an American, Thomas Sullivan.

Chapter 2, From the Leaf to the Cup, explains how tea leaves, flowers, and buds are harvested, withered, rolled and chopped, dried or briefly fermented, and processed. Pettigrew points out that there are seven different main types of tea: white tea, green tea, oolong tea, black tea, compressed tea, flavored tea, and Pu-erh tea. Finished tea leaves are sorted and graded into various leaf and broken leaf grades, known as pekoe and broken pekoe, with all sorts of sub-divisions to denote size, appearance, and color. Every tea factory or company has a team of tea tasters who are then responsible for checking the quality of the teas and preparing them for sale.

Like the science and art of producing fine wine, the same kinds of environmental factors play a rôle in the flavor of tea: the soil where the bushes grow, when during the day, season, and the year the leaves are picked, where on the plant the leaves are harvested, the temperature and moisture of the region, how the leaves are handled, processed, shipped and stored. She tells why even the minerals in the water and the temperature of the water the tea is steeped in will give different flavors. It's no wonder most Americans don't like tea. We are too busy to check all this out!

Chapter 3, Tea Around the World, is an alphabetical journey to the various countries of the world where tea is grown, beginning with Australia and ending with Zimbabwe. Tea is presently grown in the United States at the

Charleston Tea Plantation on Wadmalaw Island, 20 miles south of Charleston, South Carolina and is sold in this country under the brand name American Classic Tea. All other teas sold in this country are imported and blended with teas from various countries to give the different flavors and aromas.

Chapter 4, Tea Ceremonies, explains that every country around the world has developed its own ways of preparing and serving tea from the powdered, whisked green tea of Japan to the strong concentrated black tea of Russia. There are certain general rules that must be followed for the best infusion: 1. always use freshly drawn cold water; 2. use tea that has been carefully stored in an air-tight container; 3. choose the right size brewing vessel or teapot; 4. warm the pot with a small amount of warmed water, swirl it around and then discard; and 5. measure the tea carefully – the general rule is one rounded teaspoon or bag of tea per cup. Bring the water to boiling, cool slightly, pour over the leaves and steep. The size of the leaf particles and the time steeped will vary with the type of tea.

Chapter 5, Tea Drinks and Recipes, Chapter 6, Herbal and Fruit Infusions, and Chapter 7, Tea and Health are self-explanatory by their titles.

The Glossary is rather brief for a person not knowing much about tea. For example such frequently used words throughout the book like: broken grades, decaffeinated tea, Earl Gray, instant tea, oolong, orthodox tea, and withering are not mentioned. The reader must go to the Index and then find the page where the words are defined and used.

I found the book very enjoyable reading and at \$14.95 a most acceptable price for a four-color book. Never again will I just accept that all tea is the same. I have become a much more discriminating consumer and will demand more than “just a cup of tea.” I may just start carrying my own tea caddies or tea bags so I can experience a truly great cup of tea. So might you.

—Dennis W. Woodland

Biology Department, Andrews University
Berrien Springs, Michigan 49104-0410 U.S.A.
e-mail: woody@andrews.edu
Telephone: 616.471.3240; FAX: 616.471.6911

ANNOUNCEMENT

Effective immediately, the address of the University of Michigan Herbarium will be:

University of Michigan Herbarium
3600 Varsity Drive, Suite 112
Ann Arbor, Michigan 48108-2287

It is expected that this address will continue in use for 5–7 years, and possibly longer. It is urged that you use the 4-digit extension on the Zip Code, because the University uses that for local deliveries.

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On the Cover: *A view of the Norwegian Bay Wetlands,
Green Lake, Green Lake County, Wisconsin.
Photograph by Thomas L. Eddy, 2 September 2000.*

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THE

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FLORA AND VEGETATION OF THE GRAND TRAVERSE ISLANDS (LAKE MICHIGAN), WISCONSIN AND MICHIGAN

Emmet J. Judziewicz

Senior Conservation Biologist
Bureau of Endangered Resources
Wisconsin Department of Natural Resources
Madison, WI 53707-7921

ABSTRACT

The results of a rare plant, floristic, and plant community survey of the Grand Traverse Islands archipelago are presented. Stretching from Wisconsin's Door Peninsula to Michigan's Garden Peninsula, these Lake Michigan and Green Bay islands are largely underlain by Silurian dolomite that outcrops along shorelines as high, white cedar-dominated cliffs (on west coasts), low wave-washed shelves (east coasts), and, occasionally, interior escarpments. Most islands experienced intensive human use in the 19th century (fishing, concomitant logging and farming) but have now recovered to second- and third-growth forests. An exception is Washington Island, the largest in the archipelago, which has a permanent human population and much cultivated or formerly cultivated land. Islands larger than about 100 ha have interiors dominated by beech (*Fagus grandifolia*)—sugar maple (*Acer saccharum*) forests that may have rich spring ephemeral displays, including, on Washington and Rock Islands, the rare disjunct broad-leaved wood sedge (*Carex platyphylla*). These mesic forests are best developed on the western and northern sides of islands, where glacial till overlies dolomite. The eastern shores often have boreal conifer-dominated beach ridge and swale complexes (best developed at Jackson Harbor on Washington Island) with regional endemic calciphiles such as dwarf lake iris (*Iris lacustris*) and boreal disjuncts like northern comandra (*Geocaulon lividum*). Small dune complexes may have regional endemics such as Pitcher's thistle (*Cirsium pitcheri*) and Lake Huron tansy (*Tanacetum huronense*), but these appear to be declining due to intensive human use of Great Lakes beaches.

Dolomitic shoreline bedrock communities—now known as Great Lakes alkaline rockshores—are present on eastern and southeastern coasts of islands and are best developed on Summer, Poverty, Washington, Detroit, and possibly St. Martin Islands. On Poverty and Summer Islands, such communities grade inland into alvar, a globally rare community. Chambers Island is low and sandy and has extensive second-growth hemlock-hardwood forests and small remnant Great Lakes barrens communities with southern sand prairie or pine barrens species that are rare or absent elsewhere along the shores of northern Lake Michigan. Washington Island has a number of interesting interior wetlands including boreal fens at Little Lake, Coffee Swamp, and Big Marsh.

The plants and communities of all of the islands are experiencing a "crunch" of negative factors including: Deer herbivory on large islands, which is affecting tree regeneration and the survival of understory herbs such as those in the lily and orchid families; and, invading colonial waterbirds on small (less than about 10 ha) islands—the birds have nearly killed all arboreal vegetation.

Some 797 vascular plant species are recorded from the islands, including two federally listed species, 59 species listed as endangered, threatened, or special concern by the state of Wisconsin, and nine listed by endangered, threatened, or special concern by the state of Michigan.

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INTRODUCTION

The island chain that stretches from Green Bay and the tip of Wisconsin's Door Peninsula to the tip of Michigan's Garden Peninsula is here recognized as the "Grand Traverse Islands (Fig. 1)." This is not a well-known term in either

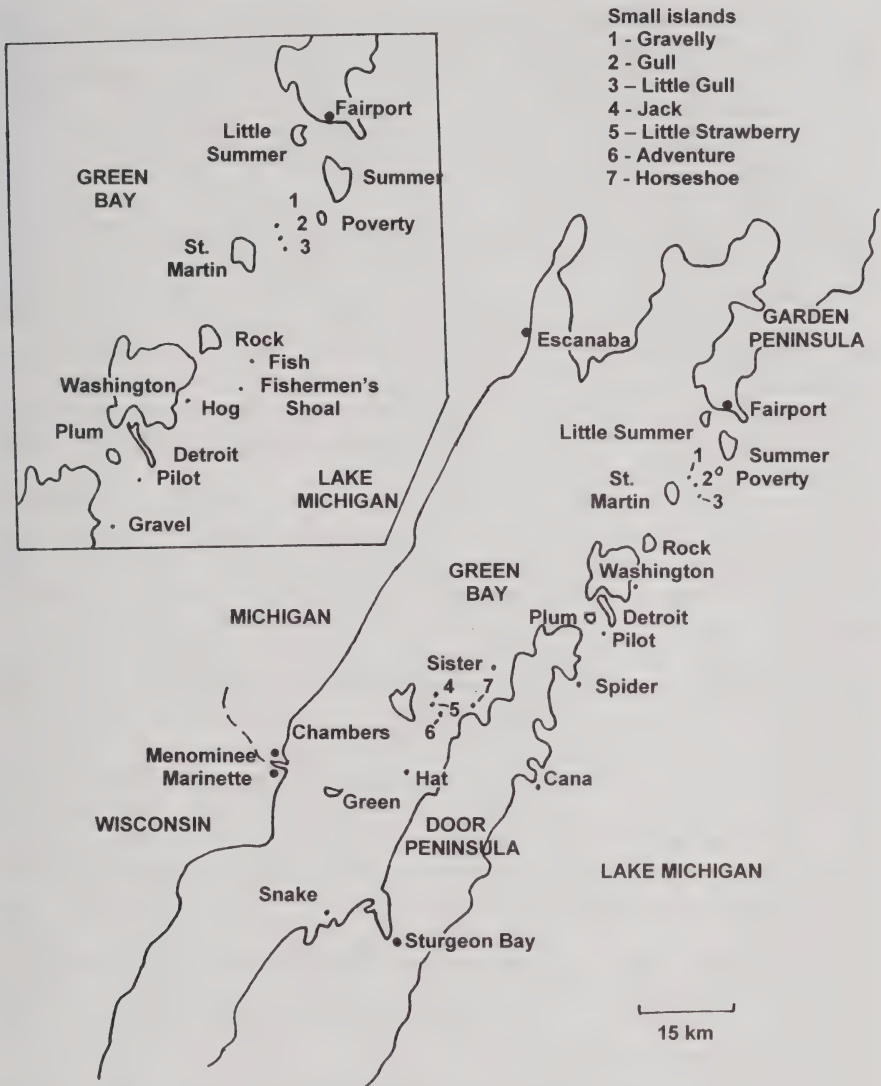


FIGURE 1. Map of the Grand Traverse Islands, Wisconsin and Michigan.

Wisconsin or Michigan. But, it aptly describes the physiographic context of this island chain and its biological role as a series of stepping stones from the Door to the Garden Peninsulas. The term was most recently used in the 1970s by the Wisconsin Department of Natural Resources (WDNR) in an unsuccessful attempt to create a "chain-of-islands" park spanning the Badger and Wolverine States (Huntoon 1977).

Geologically, the islands, with the exception of Green and Chambers Islands

in Green Bay, are underlain by middle Silurian dolomites that dip east down into Lake Michigan, resulting in high cliffs on the west and northwest sides of some islands, and broad pavements to low shelves on the east and southeast coasts (Schrock 1940, Dorr & Eschman 1984, Palmquist *et al* 1991, Albert *et al.* 1997). Several types of dolomites are present: the Engadine Group close to Lake Michigan, including, for example, the southeast one-half of St. Martin Island, all of Poverty Island, and the southeast one-half of Summer Island, Michigan; the Manistique Group (the northwest half of Summer Island), and the Burnt Bluff Group (part of Little Summer Island). All of these formations are part of the Niagara escarpment which runs from eastern Wisconsin to Ontario and New York.

The vegetation of the Grand Traverse Islands is principally second-growth mixed although mainly deciduous forests, with an admixture of more conifers, natural wetland and shoreline features, and general diversity near the coasts. Although many of the islands hosted fishing villages and subsistence farming during the middle of the 19th century, only Washington was (and to some degree still is) extensively cultivated for agriculture.

The islands' plants and plant communities face a number of challenges. White-tailed deer are probably now as widespread, numerous, and damaging as they have ever been in the archipelago; the vegetation of the smaller islands has been devastated by colonial waterbirds in the past decade; and human development is proceeding on Chambers, Washington, and Little Summer Islands.

One reads accounts of what these islands were like only 25 or 75 years ago with disbelief. Plum Island had old-growth hardwoods with a luxuriant Canada yew understory as recently as 1974; Spider Island was a veritable garden of Indian paint-brush, blue flag, and wood lily under tamaracks and cedars; now-deserted bird islands like Pilot had bustling human mini-communities based on lighthouse-tending; and on Washington Island, butternut was a common forest tree, and calypso orchids were so common that they were used to decorate grave-stones on Memorial Day. The one thing that struck me in researching and writing this paper, is how quickly changes can occur on these small, relatively open systems called islands. And substantial, largely negative changes are in the offing in the coming decades, such as the threat of the destruction of the wonderful spring ephemeral displays on Rock Island by invading garlic mustard (*Alliaria petiolata*)—a species that, ironically, may have been inadvertently introduced to the island by hikers and tent campers.

Here I provide a snapshot of a significant part of the natural history of the Grand Traverse Islands as they appear at the end of the 20th century (Table 1).

History of Biological Exploration (Table 2)

In spite of their relative proximity to urban areas, the history of biological surveys of the Grand Traverse Islands began rather late—in fact over 50 years later than that of the more remote Apostle Islands (Judziewicz & Koch 1993). The first known plant collections are a few made by J.H. Schuette on Washington Island from 12–14 and 23 September 1889. Next, E. Bruncken of the Milwaukee Public Museum (MIL) made collections on “Strawberry” (now Adventure) Island on 17 July 1897. Over the next 35 years, MIL sent various collectors to ex-

TABLE 1. Summary of the Grand Traverse Islands

ISLAND	County	State	Area (ha)	Height Above Lake (m)	Docu- mented		Predicted		Thorough- ness of Survey	WI Listed		MI Listed		WI and/or MI Listed		White- tailed Deer?	Canada yew?	Colonial water- birds?	Interior wetlands?
					No.	Species	No.	Species		Spp.	Spp.	Spp.	Spp.	Spp.	Spp.				
Snake	Door	WI	11	2	156				Excellent	0		0		0		?	No	Light	Yes
Green	Marquette	WI	32	7	92		156	0.59	Excellent							No	Common	Moderate	No
Cana	Door	WI	3.5	3	111		92	1.16	Excellent	1		1		1		Yes	No	No	No
Hat	Door	WI	1.5	2	22				Good	0		0		0		No	No	Heavy	No
Chambers	Door	WI	1050	17	358		398	0.89	Excellent	4		4		4		Past	Rare	No	Large
Adventure	Door	WI	8	5	58				Fair	0		0		0		No	Common	No	No
Little																			
Strawberry	Door	WI	2.5	4	44				Good	1		1		1		No	No	Moderate	No
Jack	Door	WI	2	5	28				Good	2		2		2		No	No	Heavy	No
Horseshoe	Door	WI	10.5	10	49				Fair	1		1		1		Yes	No	No	No
Sister	Door	WI	2.5	1	6				Poor	0		0		0		No	No	Heavy	No
Spider	Door	WI	7	3	42		70	0.6	Fair			0		0		No	No	Heavy	No
Gravel	Door	WI	0.7	1	0				Good	0		0		0		No	No	Heavy	No
Plum	Door	WI	108	13	259		226	1.15	Good	4		4		4		Yes	No	No	Moderate
Detroit	Door	WI	260	25	340		281	1.18	Good	11		11		11		Yes	Rare	No	No
Pilot	Door	WI	1.2	3	40				Excellent	1		1		1		No	No	Heavy	No
Washington	Door	WI	5801	53	626		611	1.02	Excellent	44		44		47		Yes	Rare	No	Moderate
Hog	Door	WI	0.8	2	34				Excellent	0		0		0		No	Rare	Heavy	No
Rock	Door	WI	325	65	333		297	1.12	Excellent	16		16		18		Yes	Rare	No	No
Fish	Door	WI	0.5	2	0				Good	0		0		0		No	No	Heavy	No
St. Martin	Delta	MI	523	35	183		335	0.55	Fair			7		12		Yes(?)	Uncommon?	No	Small
Gravelly	Delta	MI	1	2	24				Good			1		1		No	No	Heavy	No
Little Gull	Delta	MI	2	2	43				Good			1		2		No	No	Heavy	No
Gull	Delta	MI	5.5	3	42				Good			1		1		No	No	Heavy	No
Poverty	Delta	MI	78	18	203		208	0.97	Excellent			3		15		Yes	Common	No	No
Summer	Delta	MI	891	41	376		382	0.98	Excellent			8		28		Yes	Rare	No	Small
Little																			
Summer	Delta	MI	225	12	180		271	0.65	Fair			2		4		Yes	No	No	No
TOTALS					9342		797			59		9		63					

TABLE 2. Plant collectors of the Grand Traverse Islands

ISLAND	County	State	Collector(s)	Affiliation	Numbers	Date(s)	Deposition
Snake	Door	WI	Emmet J. Judziewicz	WDNR	few	5 May, 19 July 2000	WIS
Green	Marinette	WI	Emmet J. Judziewicz, John Huff	WDNR WDNR	13189-13276 14023-14034, 14100-14112	8-Jun-1998 9-Aug-1999	WIS WIS
Cana	Door	WI	Theodore S. Cochrane, Barbara A. Cochrane	UW-Madison	few in vicinity of 10459	10 Sept. 1984	WIS
	Door	WI	E.J. Judziewicz	WDNR	13277-13278	16-Jun-1998	WIS
Hat	Door	WI	E.J. Judziewicz, Joel A. Trick	WDNR, USFWS	12693, sight records	6-May-1998	WIS
Chambers	Door	WI	Norman C. Fasset Donald Ugent	WIS UW-Madison	few in 17373 range 1000-1268	15-Jun-1935 2, 11, 16 July and 27 Aug. 1961	WIS WIS
			E.J. Judziewicz	WDNR	12702-12759	8-9 May 1998	WIS
			E.J. Judziewicz & David Kopitzke	WDNR	13719-13776	25-Jun-1998	WIS
			E.J. Judziewicz	WDNR	13899-13992	18-19 Sept 1998	WIS
Adventure (Strawberry)	Door	WI	E. Brunken	Milwaukee Public Museum	9 collections	17 July 1897	MIL
			E.J. Judziewicz, J.A. Trick J.W. Seaquist	WDNR, USFWS	sight records few	6-May-1998 30 May, 17 June 1947	WIS
Little Strawberry	Door	WI	J.W. Seaquist		few	30 May, 17 June 1947	
	Door	WI	E.J. Judziewicz, J.A. Trick	WDNR, USFWS	12697-12700, sight records	6-May-1998	WIS
Jack	Door	WI	N.C. Fasset E.J. Judziewicz, J.A. Trick	UW-Madison WDNR, USFWS	few in 17300 range sight records	15-Jun-1935 6-May-1998	WIS
Horseshoe	Door	WI	E.J. Judziewicz, J.A. Trick	WDNR, USFWS	12694-12696, 12701, sight records	6-May-1998	WIS

Sister	Door	WI	William E. Tans	WDNR	sight records	1977
Spider	Door	WI	Milwaukee Public Museum Expedition (E. Bruncken?)	Milwaukee Public Museum	12 collections	1-Jul-05
			Gary Fewless, James Moore	UW-Green Bay	about 15 collections in 3100 range	1983
Plum	Door	WI	E. Bruncken	Milwaukee Public Museum	few	9-Jul-1905
			W.E. Tans	WDNR	few in 790-810 range	22-Jul-1974
			S.P. Voice et al.	USFWS	few	6-Jun-1982
			E.J. Judziewicz	WDNR	12667-12692	5-May-1998
			E.J. Judziewicz & Andrew Galvin	WDNR	13279-13429	17-Jul-1998
Detroit	Door	WI	Anna Threlfall	UW-Green Bay	one collection	July-1971
			William S. Alverson	WDNR	few in 1240-1310 range	26-Jul-1979
			E.J. Judziewicz	WDNR	12657-12666	4-May-1998
				WDNR	12771-12797	14-May-1998
				WDNR	13431-13602	18-Jun-1998
Pilot	Door	WI	S.P. Voice, S.W. Milan, J.P. Ludwig	Ecological Research Services, Inc.	13840-13895	16-Sep-1998
			E.J. Judziewicz, J. Trick, A. Galvin	WDNR, USFWS	few	5-Jun-1982
Washington	Door	WI	J.H. Schuette	WDNR, USFWS	14037, sight records	22-Jul-1999
			John J. Davis	UW-Madison	few	30 July 1887, 12-14, 23 Sept. 1889
						26 July 1913, 2 July 1931

(Continued)

TABLE 2. Plant collectors of the Grand Traverse Islands (Continued)

ISLAND	County	State	Collector(s)	Affiliation	Numbers	Date(s)	Deposition
			Charles Goessl	Milwaukee Public Museum	3908-3993	15-16 June 1916	MIL, WIS
			Albert M. Fuller	Milwaukee Public Museum	about 261, in 1356-1615, 1670-1680	21-26 July 1926 2 June 1927	MIL
			Herbert Moussa	Milwaukee Public Museum	few	25 Aug. 1928	MIL
			A.M. Fuller	Milwaukee Public Museum	3660-3670	01-Jun-1930	MIL
			S.C. Wadmond				
			Richard W. Pohl		few	8 Sept. 1934	MIL
			Emil P. Kruschke	Milwaukee Public Museum	few	11-12 June 1935	MIL
					few; mostly <i>Crataegus</i>	6 June 1949, 4 Sept. 1951	MIL
			Neil A. Harriman		several in 4530 range	14-Jun-1969	OSH
			A. Threlfall	UW-Green Bay	about 100	around 24 July 1971	UWGB
			Theodore S. Cochrane, Barbara A. Cochrane	UW-Madison	5233-5279	23-Jul-1972	WIS
			Virginia Rose	UW-Green Bay	less than 100 in 1-402 range	1972-1982	UWGB
			W.E. Tans	WDNR	few in 800 range	22-Jul-1974	MIL, WIS
			Nancy Schutz	UW-Green Bay	about 125 in 1-175 range	28-May-1905	UWGB
			T.S. & B.A. Cochrane	UW-Madison	11038-11138	11-12 June 1985	WIS
			James H. Zimmerman	UW-Madison	sight records	1988	
			G. Fewless, often with J. Moore	UW-Green Bay	5148-5208, 5483-5570, 5926-5960, 6935 ranges	1989-1991	UWGB
			E.J. Judziewicz	WDNR	12647-12656		WIS
				WDNR	12670-12770	30-Apr-1998	WIS
				WDNR	13006-13093	13-May-1998	WIS
				WDNR	13180-13188	1-2 June 1998 4-Jun-1998	WIS

Hog	Door	WI	E.J. Judziewicz, J.A. Trick, A. Galvin	WDNR	13603-13636	23-Jun-1998	WIS
				WDNR	13694-13718	8-Jul-1998	WIS
				WDNR	13777-13811	9-10 Sept. 1998	WIS
				WDNR	13838-13839	15-Sept. 1998	WIS
				WDNR	13896-13898	17 Sept. 1998	WIS
				WDNR	14001-14019	10-Jun-1999	WIS
				WDNR, USFWS	14035-14036, sight records	22-Jul-1999	WIS
Rock	Door	WI	W.E. Tans G.J. Knudson A. Threlfall T.S. & B.A. Cochrane W.E. Tans E.J. Judziewicz	WDNR WDNR UW-Green Bay UW-Madison WDNR WDNR WDNR WDNR WDNR	few sight records 14 collections 5175-5232 few in 800-820 range 12480-12553 12697-12646 13095-13179 13637-13693 13812-13838 sight records	Oct. 1969 June, Sept. 1964 1971 22-Jul-1972 22-Jul-1974 5-7 Sept. 1997 29-30 Apr 1998 03-Jun-1998 24-Jun-1998 15 Sept. 1998 15-May-1999	WIS WIS UWGB WIS MIL, WIS WIS, MIL WIS WIS WIS WIS
			E.J. Judziewicz, T.S. Cochrane, R. Freckmann	WDNR, UW- Madison, Steven Point			
St. Martin	Delta	MI	A.M. Fuller	Milwaukee Public Museum	about 15 in 1600 range	26-Jul-1926	MIL
			Eric Bourdo, Jr.	Ford Forestry Center	few in 20000 range	9-11 Aug. 1969	MSC
			James Wells, Paul Thompson, Kathleen Forzley, Phyllis Higman, Fons, Empson	Cranbrook Institute of Science, Oakland University	over 100 in "89." series	6-11 July 1989	BLH

(Continued)

TABLE 2. Plant collectors of the Grand Traverse Islands (Continued)

ISLAND	County	State	Collector(s)	Affiliation	Numbers	Date(s)	Deposition
Gravelly	Delta	MI	J. Wells, P. Thompson, K. Forzley, P. Higman, Fons, Empson	Cranbrook Institute of Science, Oakland University	over 100 in "90-" series	9-12 July 1989	BLH
			Sylvia Taylor	Michigan State University	few	24-Jul-1978	MSC
Little Gull	Delta	MI	J. Wells, P. Thompson, K. Forzley, P. Higman, Fons, Empson	Cranbrook Institute of Science, Oakland University	several dozen	1989	BLH
			J. Wells, P. Thompson, K. Forzley, P. Higman, Fons, Empson	Cranbrook Institute of Science, Oakland University	several dozen	1989	BLH
Gull	Delta	MI	J. Wells, P. Thompson, K. Forzley, P. Higman, Fons, Empson	Cranbrook Institute of Science, Oakland University	few	1989	BLH
Poverty	Delta	MI	S.P. Voice et al. J. Wells, P. Thompson, K. Forzley, P. Higman, Fons, Empson Michael R. Penskar & Patrick Comer E.J. Judziewicz	USFWS Cranbrook Institute of Science, Oakland University Michigan Natural Features Inventory Michigan Natural Features Inventory	few about 150 sight records (ecological surveys) 12799-12841	7-Jun-1982 1989-1990 ca. 1995 26-May-1998	MICH BLH WIS, MICH

Summer	Delta	MI	Melvin Tessene Dale Hagenah Edward G. Voss	University of Michigan	1-275 few in 6650-6750 range 12604-12653	30 May-Aug. 1968 31-May-1968 30-May- 1 June 1968	MICH BLH MICH
			Eric Bourdo, Jr. E.G. Voss	Ford Forestry Center University of Michigan	few in 20000 range 13363-13403	9-11 Aug. 1969 4-Jul-1970	MSC MICH
			Charles A. Long Robert W. Freckmann	UW-Stevens Point UW-Stevens Point UW-Stevens Point	several dozen 13103-13140 13152-13289	27-Jul-1974 1 Aug. 1976 24 Aug. 1976	UWSP UWSP UWSP
			J. Wells, P. Thompson, K. Forzley, P. Hignman, Fons, Empson	Cranbrook Institute of Science, Oakland University	several hundred	6-11 July 1989	BLH
			J. Wells, P. Thompson, K. Forzley, P. Hignman, Fons, Empson	Cranbrook Institute of Science, Oakland University	several hundred	9-12 July 1990	BLH
			M.R. Penskar & P.J. Comer	Michigan Natural Features Inventory	sight records (ecological surveys)	ca. 1995	
			E.J. Judziewicz	Michigan Natural Features Inventory	12842-12915	27-28 May 1998	WIS, MICH
Little Summer	Delta	MI	R.W. Freckmann	UW-Stevens Point	13141-13151	26 Aug. 1976	UWSP
			E.J. Judziewicz	Michigan Natural Features Inventory	12916-13005	29 Aug. 1998	WIS, MICH

plore the archipelago including trips to Spider and Plum Islands in 1905, Charles Goessl's (1866–1941) trip to Washington and Hog Islands in 1916, and the surveys of Albert M. Fuller (1899–1981) on Washington Island in 1926, 1927 (Fuller 1927), and 1930.

With one exception, from 1931 to 1967 virtually no collections were made in the archipelago.

Then, a flurry of collecting occurred on various islands from 1968–1976. Summer Island, starting in 1968, was visited by a number of botanists associated with Michigan institutions (University of Michigan, Ford Forestry Center, Michigan State University), who worked out of Dan Stevens' Summer Science, Inc. camp at Summer Harbor on Summer Island: Melvin Tessene, Dale Hagenah, Edward G. Voss, and Eric Bourdo, Jr. Bryologists Norton G. Miller and Richard L. Halbert collected mosses and liverworts in July 1968 and published an annotated list of 130 species for Summer Island (Miller & Halbert 1971), including several boreal disjuncts and species new to Michigan. And, for a brief period (two volumes), there was even a Summer Science Journal that published the results of student surveys of the island's fauna and flora (Domke 1970, Larson 1969, Rhodes 1970)! In the 1970s, University of Wisconsin-Stevens Point (UWSP) mammologist Charles A. Long presented the results of a survey of the mammals of the Grand Traverse Islands in a series of papers (Long 1978, Long & Long 1976, Long *et al.* 1978). Long also facilitated the plant collecting visits of UWSP botanist Robert W. Freckmann (Fig. 54) to Summer and Little Summer Islands in 1976.

Meanwhile, on the Wisconsin islands, botanical activity was intensifying. Anna Threlfall (University of Wisconsin-Green Bay, UWGB) became the first botanist to collect on Detroit and Rock Islands, and she made quite a few collections on Washington Island, too. Theodore S. (Fig. 54) and Barbara A. Cochrane (WIS) made significant contributions to the flora of Washington and Rock Islands in 1972 and 1985, collecting at Jackson Harbor, Mountain Park, and Boyer Bluff on the former island, and all over Rock Island.

In 1974, Wisconsin Department of Natural Resources (WDNR) botanist William E. Tans made brief reconnaissances of Plum, Washington, and Rock Islands, surveying their rare floras and communities; William S. (Bil) Alverson supplemented this with visits to Rock and Detroit Islands in 1979.

From 1989–1991, Gary Fewless (UWGB) made meticulous surveys of the flora and vegetation of Jackson Harbor Ridges on Washington Island; today there are more than 500 collections from the archipelago housed at UWGB.

Chambers Island was briefly visited by WIS herbarium director Norman C. Fassett (1900–1954) in 1935, and collected extensively by Donald Ugent in 1961.

A U.S. Fish and Wildlife Service survey of federally listed rare plants (such as dwarf lake iris, *Iris lacustris*) on the islands was made in 1982. S.P. Voice headed this survey, which visited Poverty, Pilot and Plum Islands.

A major expedition was the joint Cranbrook Institute of Science—Oakland University team that visited all of the Michigan islands (except Little Summer) in 1989 and 1990. The results of this survey, which was facilitated by transportation provided by the U.S. Coast Guard, are detailed by Forzley *et al.* (1993),

and the specimens (1,000–1,500 collections) are housed in the Cranbrook Institute of Science herbarium (BLH). It should be noted that this expedition also visited and collected plants on several small islands in Big Bay de Noc on the west side of the Garden Peninsula (Round Island, St. Vital Island, and Little Guss Island). These islands are not treated in the 1993 paper or the present paper, but a considerable number of specimens from these islets are housed at BLH.

In 1995, Michael R. Penskar, Patrick J. Comer, and David L. Cuthrell of the Michigan Natural Features Inventory visited Summer and Poverty Islands to characterize alvar and other selected natural communities, and conduct rare plant and insect surveys (Albert *et al.* 1997).

Scope of the Present Study

From September 1997 through August 1999, 15 collecting trips were made to the Grand Traverse Islands (Kopitzke 1999a, 1999b), and about 1,550 collections were made in my collecting number range of 12,480–14,112. The majority of these collections are deposited at WIS, with the few Delta County, Michigan county voucher records deposited at MICH. It was desirable to visit the lesser known islands several times during the field season (Table 2).

Visits were also made to the following herbaria in Wisconsin and Michigan to search for and verify GTI collections: University of Wisconsin-Madison (WIS), University of Wisconsin-Stevens Point (UWSP), University of Wisconsin-Green Bay (UWGB), Milwaukee Public Museum (MIL), University of Michigan (MICH), Michigan State University (MSC), and Cranbrook Institute of Science, Bloomfield Hills, Michigan (BLH). It is believed that over 95% of GTI collections are housed in these seven institutions, which have over 4,000 total GTI specimens (excluding duplicates). Literature pertinent to the botanical exploration of the islands was also consulted (Fuller 1927; Forzley *et al.* 1993; Voss 1972, 1985, 1996; Wetter *et al.* 1999), plus the databased records from both the Wisconsin Natural Heritage Program and the Michigan Natural Features Inventory.

In summary, it appears that the following islands (Table 1) have excellent floristic coverage, with at least 90% of their species known: Green, Cana, Chambers, Pilot, Washington, Hog, Rock, Poverty and Summer. Islands that require much more extensive surveys include St. Martin and Little Summer, and many of the smaller “bird” islands that have been visited only once, often either early or late in the year.

PLANT COMMUNITIES

Mesic Forest (Tables 4, 5)

The majority of the pre-settlement upland forests of the Grand Traverse Islands were dominated by forests of beech (*Fagus grandifolia*) and sugar maple (*Acer saccharum*). Other important tree species—in rank order of their importance values in the General Land Office survey notes of the 1830s and 1840s

TABLE 3. Importance values of pre-settlement trees of the Grand Traverse Islands (based on general land office survey, 19th century).

Surveyor's name	Scientific name	Chambers Island	Plum Island	Detroit Island	Washington Island	Rock Island	Weighted average all islands
Beech	<i>Fagus grandifolia</i>	7.1	0	6.7	25.1	27	21.7
"Sugar"	<i>Acer saccharum</i>	7.1	70	0	19.1	20.9	17.6
"Pine"	Probably mostly <i>Pinus strobus</i> , some <i>P. resinosa</i> on Chambers Island as "black pine"						
Cedar	<i>Thuja occidentalis</i>	35	0	0	8.5	0	11.4
"Birch"	<i>Betula alleghaniensis</i> and <i>B. papyrifera</i>	0	15	34	10.5	16	10.1
		1.5	0	13.3	9	7.1	7.9
"Spruce"	<i>Picea glauca</i> , <i>P. mariana</i> , and probably <i>Abies balsamea</i>	1	15	20.5	7.1	10.3	6.8
Oak, "Black Oak"	<i>Quercus rubra</i>	25	0	0	3.5	3.3	6.3
"Aspen"	<i>Populus tremuloides</i> and <i>P. grandidentata</i>	3.7	0	17.4	5.6	15.2	5.9
Hemlock	<i>Tsuga canadensis</i>	12	0	0	4.6	0	5.2
"Lynn"	<i>Tilia americana</i>	3.2	0	0	2.3	0	2.2
Ironwood	<i>Ostrya virginiana</i>	1	0	2.4	2.6	0	2.1
Tamarack	<i>Larix laricina</i>	0	0	3.6	0.9	0	0.9
Black ash	<i>Fraxinus nigra</i>	0	0	0	0.3	0	0.3
Willow	<i>Salix</i> spp.	0.7	0	2.1	0.1	0	0.3
White ash	<i>Fraxinus americana</i>	0	0	0	0.2	0	0.2
Red maple	<i>Acer rubrum</i>	1.5	0	0	0	0	0.2
Elm	<i>Ulmus americana</i>	1	0	0	0	0	0.1
		100	100	100	100	100	100
Mesic Hardwoods	Beech, sugar maple, birch	28	70	42	65	70	59.4
Xeric Hardwoods	Oak	25	0	0	3.5	3.3	6.3
Upland Conifers	Pines, Hemlock	47	0	0	13.1	0	16.6
Swamp Conifers	Cedar, spruce, tamarack	1	30	58	18.5	26.3	17.7

TABLE 4. Southern mesic forest species at or near their northern range limits in the Grand Traverse Islands.

<i>Agastache scrophulariaefolia</i> (Washington Island)
<i>Carex albursina</i> (Washington Island)
<i>C. blanda</i> (Washington Island)
<i>C. hirtifolia</i> (Rock Island)
<i>C. hitchcockiana</i> (Little Summer Island)
<i>C. prasina</i> (Rock Island)
<i>C. sparganioides</i> (Washington and Rock Islands)
<i>C. sprengelii</i> (Little Summer Island)
<i>Cryptotaenia canadensis</i> (St. Martin Island)
<i>Elymus villosus</i> (Rock Island)
<i>Galium lanceolatum</i> (Chambers, Washington, and Rock Islands)
<i>Hamamelis virginiana</i> (Washington Island)
<i>Hydrophyllum virginianum</i> (Snake and Rock Islands)
<i>Juglans cinerea</i> (Washington Island)
<i>Phlox divaricata</i> subsp. <i>laphamii</i> (St. Martin Island)
<i>Podophyllum peltatum</i> (Chambers Island)
<i>Viburnum acerifolium</i> (Washington and Rock Islands)

TABLE 5. Eastern North American species at or near their western range limits in the Grand Traverse Islands (*—presumed extipated in the archipelago).

<i>Acer pensylvanicum</i> (Summer Island)
<i>Carex platyphylla</i> (Washington and Rock Islands)
<i>Galium brevipes</i> (Summer Island)
<i>Medeola virginiana</i> (Washington Island)*
<i>Trisetum melicoides</i> (Summer Island)
<i>Viola rostrata</i> (Washington Island)

(Table 3) were aspen (*Populus* spp.), birch (*Betula* spp.), eastern hemlock (*Tsuga canadensis*), basswood (*Tilia americana*), and hop-hornbeam (*Ostrya virginiana*). Presumably there were also large individuals of white pine (*Pinus strobus*) scattered throughout all but the wettest sites. Butternut (*Juglans cinerea*) was recorded to have been an important forest tree at least through the 1920s on Washington Island (Fuller 1927), but has declined since there because of logging and disease. Logging, agriculture, and fishing activities starting in about the 1840s had profound effects on the original vegetation, and these mesic forests of the islands were heavily impacted by settlement. The richest sites on Washington Island were cut and converted to agriculture, and most other stands were logged, sometimes repeatedly. The best mesic forest stand extant today is the old-growth beech-sugar maple woods that occupies the majority of the upland areas on Rock Island (Figs. 2, 52). It is classified by the Wisconsin DNR as a southern mesic forest, since hemlock is absent. Apparently, old-growth mesic stands also existed on St. Martin Island until at least 1926 (Fuller 1927). Today mesic forests may be found in the interiors of all islands greater than 100 ha in size. Many are impacted by deer herbivory and have scant regeneration of any tree species except beech, which is unpalatable to deer. The numerous private woodlots extant on Washington Island are of interest in that many contain populations of the disjunct broad-leaved wood sedge (*Carex platyphylla*).



FIGURE 2. Old-growth sugar maple (*Acer saccharum*) forest on Rock Island. Note beech (*Fagus grandifolia*) saplings and wild leeks (*Allium tricoccum*) in the understory, 29 April 1999. There is no sugar maple regeneration in this stand because of deer herbivory.

Understory shrubs are not important components of these mesic forests, although disturbed stands have beaked hazelnut (*Corylus cornuta*), red raspberry (*Rubus idaeus* var. *strigosus*), and species of gooseberries (*Ribes* spp.). The composition of the groundlayer varies greatly from island to island. Some have outstanding spring ephemeral displays (Rock, Detroit, and parts of Washington and Little Summer Islands), while others have poor displays (Chambers and Summer Islands). If ephemerals are present, the most common ones are Carolina spring-beauty (*Claytonia caroliniana*), wild leek (*Allium tricoccum*), dutchman's-breeches (*Dicentra cucullaria*), and hepaticas (*Anemone acutiloba* and *A. americana*), along with mesophytic grasses such as wood millet (*Milium effusum*) and nodding fescue (*Festuca subverticillata*). Woodland sedges of *Carex* Section *Laxiflorae*, often species with broad leaf blades, are characteristic of these forests: *C. laxiflora* is frequent, and *C. albursina*, *C. blanda*, *C. ormostachya*, *C. plantaginea* and the eastern disjunct *C. platyphylla* are also present. A number of southern disjunct species are found in the richest, least disturbed, often highest elevation stands on Washington and Rock Islands (Tables 4 and 5); these are discussed in the "Floristics and Biogeography" section of this paper.

Interior springs and streams of any type are rare on the islands because of their porous dolomite substrate. However, hardwood seeps are a small specialized wetland community type that may occur within mesic forests. Seeps are best developed in the interior of the Rock Island, where a small opening in an interior basin that slopes down to the north is dominated by ostrich fern (*Matteuc-*



FIGURE 3. Second-growth sugar maple (*Acer saccharum*) forests in the interior of Summer Island, Michigan, 27 May 1998. Stands on this island are currently selectively cut, suffer from high deer densities, and have a past history of burning. Spring ephemerals are few.

cia struthiopteris), spring ephemeral herbs, meadow horsetail (*Equisetum pratense*), and the rare drooping sedge (*Carex prasina*). This particular type of community (Fig. 39) has no real analog anywhere else in Wisconsin. Summer Island also has a small interior seep (Fig. 4) dominated by bulblet fern (*Cystopteris bulbifera*).

Vernal mesic woodland ponds that are inundated in the spring, but dry by late summer, also occur in a few places in the archipelago. On Chambers Island there is one a short distance south of Mackaysee Lake, and Summer Island has two, one about 1 km north of the southwest bay, and another near the north tip of the island with northern manna grass (*Glyceria borealis*) dominant (Fig. 9).

Chambers Island, with its sandy-clayey, more acidic soils and recurrent fires, had a much different upland forest composition at the time of European settlement than the other major islands. Red oak (*Quercus rubra*) and pines (white pine and red pine, *Pinus resinosa*) were the dominants on the majority of the island, with hemlock, beech, and sugar maple of lesser importance. Today four tree species are roughly co-dominant: sugar maple, beech, hemlock, and red oak. They occur in well-mixed to nearly pure single-species stands (Figs. 20, 41, 46, 47). The herbaceous understories of the Chambers Island forests are floristically depauperate, with only Canada mayflower (*Maianthemum canadense*), wood anemone (*Anemone quinquefolia*), and a few violet species (*Viola* spp.) common.

Several of the smaller islands have mesic forests remnants. One of the most



FIGURE 4. Seeping area in hardwood forest in interior of Summer Island, Michigan. This is an uncommon "sub-community" on the islands. Bulblet fern (*Cystopteris bulbifera*) is common in the understory, 28 May 1998.

unusual is that of 3 ha Little Strawberry Island in Green Bay, which is covered with a nearly pure, pole-sized basswood stand growing on very thin soil on dolomite cobbles (Fig. 56).

Boreal Forest (Table 6 in part)

The lower, more poorly drained parts of the Grand Traverse Islands—roughly below elevations of 625–650 feet above sea level—have conifer-dominated forests with white cedar (*Thuja occidentalis*), balsam fir (*Abies balsamea*), white birch (*Betula papyrifera*), and white pine as the dominant trees. White spruce (*Picea glauca*) and showy mountain-ash (*Sorbus decora*) are also frequent. This boreal forest type is best-developed along the east coasts of Washington, Rock, and Summer Islands, and all over Poverty Island (Fig. 5). These moist, mossy forests are often associated with ancient stabilized sand dunes and gravel beaches and have rich and aesthetically pleasing groundlayer floras. On their lakeward margins, they grade into forested ridge and swale complexes, alkaline rockshore communities, and, on the Michigan Islands, alvar. Frequent species include big-leaved aster (*Aster macrophyllus*), wild sarsaparilla (*Aralia nudicaulis*), sedges (*Carex eburnea*, *C. peckii*), bunchberry (*Cornus canadensis*), wintergreen (*Gaultheria procumbens*), clubmosses (especially *Diphasiastrum digitatum* and *Lycopodium clavatum*), twinflower (*Linnaea borealis* subsp. *longiflora*), red honeysuckle (*Lonicera dioica*), cow-wheat (*Melampyrum lineare*), fringed polygala (*Polygala pauciflora*), buf-

TABLE 6. Northern/boreal species at or near their southern range limits in the Grand Traverse Islands (*—presumed extirpated in the archipelago).

<i>Calypso bulbosa</i> (Washington and St. Martin Islands)*
<i>Carex capillaris</i> (Poverty Island)
<i>C. concinna</i> (Washington and Summer Islands)
<i>Corallorhiza striata</i> (Washington, Rock, Poverty, Summer, and Little Summer Islands).
<i>Draba arabisans</i> (Detroit, Washington, and Rock Islands)
<i>D. cana</i> (St. Martin Island)
<i>Dryopteris expansa</i> (Rock Island)
<i>Geocaulon lividum</i> (Washington Island)
<i>Osmorhiza berteroi</i> (Rock Island)
<i>Parnassia parviflora</i> (Washington and St. Martin Islands)*
<i>Scirpus cespitosus</i> (Washington Island)

faloberry (*Shepherdia canadensis*), starry false Solomon's-seal (*Smilacina stellata*), and starflower (*Trientalis borealis*).

Forested Ridge and Swale Complexes (Table 6 in part)

This community type, consisting of a series of old sandy or gravelly beaches ridges and intervening wet swales, is characteristic of the eastern (Lake Michigan) shorelines of the Door and Garden Peninsulas. Typically, the ridges are forested with boreal conifer species with a mossy understory containing many rare plant species, while the swales vary from open boreal fen to closed canopy



FIGURE 5. Boreal forest of white cedar (*Thuja occidentalis*), balsam fir (*Abies balsamea*), and white spruce (*Picea glauca*) along the interior trail on Poverty Island, Michigan, 26 May 1998.

white cedar or tamarack forests, also with rare species in the understory. The Ridges Sanctuary, near Baileys Harbor in Door County, is the best-known and highest quality example of this "composite" community type (Palmquist *et al.* 1991). Jackson Harbor Ridges on Washington Island is another high quality example of the "Forested ridge and swale" community, and is the only well-developed example of its type in the archipelago. This system is a preserve of The Nature Conservancy as well as a Wisconsin State Natural Area, and has been intensively surveyed by many botanists, particularly Gary Fewless (University of Wisconsin-Green Bay), William E. Tans (Wisconsin DNR), and Theodore S. Cochrane (University of Wisconsin-Madison). Proceeding inwards towards Lake Michigan, one first encounters a series of white cedar-covered beach ridges with white spruce, balsam fir, and white pine also present, and dwarf lake iris (*Iris lacustris*), ebony sedge (*Carex eburnea*), and even the northern disjunct species northern comandra (*Geocaulon lividum*) locally common in the understory. Closer to the shore—approximately 30–100 meters from the water's edge—is a "savannah" of scattered cedars in partly open sand dunes. This woodland has a dense shrublayer of junipers (*Juniperus communis* var. *depressa* and *J. horizontalis*), associated with creeping shrubs such as bearberry (*Arctostaphylos uva-ursi*) and wintergreen (*Gaultheria procumbens*). Common herbs include beach grass (*Ammophila breviligulata*), white camass (*Zigadenus elegans* subsp. *glauca*), starry false Solomon-seal, little bluestem (*Schizachyrium scoparium*), beach wormwood (*Artemisia campestris* subsp. *caudata*), sand cress (*Arabis lyrata*), and Rocky Mountain fescue (*Festuca saximontana*). Several uncommon to rare species are characteristic of this habitat as well as habitats closer to the actual lake beach. These include dune goldenrod (*Solidago simplex* subsp. *randii* var. *gillmanii*), northern rock sandwort (*Arenaria stricta* subsp. *dawsonensis*), wood lily (*Lilium philadelphicum*), and lance-leaved tickseed (*Coreopsis lanceolata* subsp. *lanceolata*). As the dunescape open up, temporary swales and ponds (best developed on Carlin Point) support an interesting flora around their margins, with species such as bird's-eye primrose (*Primula mistassinica*), false asphodel (*Tofieldia glutinosa*), indian paint-brush (*Castilleja coccinea*), elliptic spikerush (*Eleocharis elliptica*), Buxbaum's sedge (*Carex buxbaumii*), little green sedge (*Carex viridula*), and three inconspicuous sedges (*C. aurea*, *C. garberi*, and *C. crawei*). In wet years, bladderworts (*Utricularia* spp.) may be present in the ponds. Wet sand flats along the beach boast many of the swale/pond species plus Ohio goldenrod (*Solidago ohioensis*), low calamint (*Calamintha arkansana*), variegated scouring-rush (*Equisetum variegatum*), Baltic rush (*Juncus arcticus* subsp. *littoralis*), and silverweed (*Argentina anserina*).

Interior Wetlands

Several significant interior wetlands occur in the Grand Traverse Islands. On Chambers Island, 150 ha Mackaysee Lake is associated with a series of minor swales on its western shore that harbor species such as white cedar that are not found elsewhere on the island. The lake itself has a diverse aquatic macrophyte flora, based on fragments seen washed up on its beaches. Washington Island has three major interior wetlands: Little Lake, Coffee Swamp, and the Big Marsh-



FIGURE 6. Dunes on south shore of Washington Island, Wisconsin, at Dunes Park. Beach grass (*Ammophila breviligulata*) is common here, but declining because of trampling by beachgoers. Just below center is a single fruiting plant of Pitcher's thistle (*Cirsium pitcheri*), here at its only archipelago site, 1 June 1998.

Little Marsh-Percy Johnson County Park complex, all described in detail in the "Island-by-island" summary for that island. All have rich boreal fen components, but are quite distinct from one another in physiognomy. Little Lake is a 5 ha body of water near the northwest tip of the island. It is a shallow, marl-bottomed pond and its 1 ha boreal fen somewhat resembles those of the estuaries of Lake Superior such as the mouth of the Sand River in Bayfield County, Wisconsin. Coffee Swamp (Fig. 26) bears some resemblance to fens on the Door County mainland such as Thorpe Pond. And Big Marsh is *sui generis*—when dry in late summer it features a striking white marl and dolomite gravel flat that resembles a feature of the Great Plains rather than Wisconsin (Fig. 25).

Dunescapes (Open Dunes and Beaches) (Table 7)

Dunescapes are not well-developed on the Grand Traverse Islands. The most extensive examples are the semi-stabilized 1–2 m high dunes that extend about 1 km parallel to and 100 m inland from Jackson Harbor. Here the dominants are white cedar, white pine, common juniper (*Juniperus communis* var. *depressa*), and beach grass, but a whole suite of characteristic species is also present, including regionally rare specialties. Other important dune systems on Washington Island are along the south shore extending about 1 km eastward from Dunes Park, and on the east shore extending about 1 km northward from Percy Johnson County Park. In both cases, the majority of the dunescapes are in private owner-

TABLE 7. Great Lakes dune endemics or specialties (*—extirpated).

<i>Arenaria stricta</i> (Washington Island)
<i>Cakile edentula</i> (Chambers and Washington Islands)
<i>Chamaesyce polygonifolia</i> (Chambers, Washington, and Rock Islands).
<i>Cirsium pitcheri</i> (Washington)
<i>Coreopsis lanceolata</i> subsp. <i>lanceolata</i> (Washington Island)
<i>Festuca occidentalis</i> (Plum, Washington, and Summer Islands)
<i>Iris lacustris</i> (Plum, Detroit, Washington, Rock, St. Martin, Poverty, Summer, and Little Summer Islands)
<i>Solidago simplex</i> subsp. <i>randii</i> var. <i>gillmannii</i> (Plum, Detroit, Washington, Rock, Poverty, and Summer Islands)
<i>Tanacetum huronense</i> (Rock and Summer Islands)*

ship and show less damage from human usage than adjacent parks. The dominant plants of dunescapes are beach grass, Canada wild rye (*Elymus canadensis*), and thickspike wheatgrass (*Elytrigia dasystachya* subsp. *psammophila*), and junipers. Smaller dunescapes occur on Chambers Island (Sand Point, south tip, and along the north bay), Rock Island (south beach), and Summer Island (Summer Harbor). The Rock Island dunes have been seriously degraded by beachgoers over the decades, while the Chambers Island dunes and beaches, particularly those on Sand Point and the south tip, are in relatively good shape because of difficulty of access and private ownership. The globally and regionally rare



FIGURE 7. Great Lakes pine barrens on north bay of Chambers Island, Wisconsin. The dominant trees are white and red pines (*Pinus strobus* and *P. resinosa*), the dominant shrubs, species of juniper (*Juniperus communis* var. *depressa* and *J. horizontalis*). Many sand barrens and dry prairie species occur here and nowhere else in the archipelago, 9 May 1998.

TABLE 8. Species of southern dry forests and Great Lakes pine barrens on Chambers Island (and other islands).

<i>Amphicarpaea bracteata</i>
<i>Andropogon gerardii</i>
<i>Asclepias tuberosa</i> subsp. <i>interior</i>
<i>Aster ericoides</i>
<i>A. laevis</i> (also Jackson Harbor Ridges, Washington Island)
<i>Carex brevior</i>
<i>C. muhlenbergii</i> (also Green Island)
<i>Carya cordiformis</i>
<i>Ceanothus americanus</i>
<i>C. herbaceus</i>
<i>Gaylussacia baccata</i>
<i>Heliopsis helianthoides</i>
<i>Liatris aspera</i>
<i>Lithospermum caroliniense</i> subsp. <i>croceum</i>
<i>Monarda punctata</i>
<i>Panicum latifolium</i>
<i>Potentilla arguta</i> (a historical site, only at Jackson Harbor Ridges, Washington Island)
<i>Quercus macrocarpa</i>
<i>Schizachyrium scoparium</i> (also Jackson Harbor Ridges, Washington Island)
<i>Smilax ecirrhata</i>
<i>Sorghastrum nutans</i>
<i>Sporobolus cryptandrus</i> (only at Jackson Harbor Ridges, Washington Island)
<i>Stipa spartea</i>
<i>Taenidia integerrima</i>
<i>Vicia caroliniana</i>

species Pitcher's thistle (*Cirsium pitcheri*) and Lake Huron tansy (*Tanacetum huronense*) grow (or grew) on dunescapes within the archipelago, but the thistle is now just barely hanging on, and the tansy has apparently been extirpated, because of trampling by beachgoers.

Beaches represent a narrow subset of dune communities. Characteristic species of beaches include American sea-rocket (*Cakile edentula*), seaside spurge (*Chamaesyce polygonifolia*), cocklebur (*Xanthium strumarium*), evening-primrose (*Oenothera oakesiana*), and branched knotweed (*Polygonum ramosissimum*).

Great Lakes Pine Barrens (Table 8)

This community type is very rare in Wisconsin (there is a fair amount in Michigan in the Sleeping Bear Dunes National Lakeshore). Prior to this study it was known only from Stockton Island in the Apostle Islands of Lake Superior (Judziewicz & Koch 1993), where a picturesque stand of red and white pines overtops common juniper, beach grass, blueberries, bracken fern, and various foliose lichens. A second exmple may now be described: the Sand Point and north bay dunes on Chambers Island in Green Bay. It is described in more detail in the "Island-by-island summaries" and "Floristics and biogeography" sections of this paper. This community is maintained by fires with frequencies of several decades between occurrences.



FIGURE 8. Drying marly pond (with yellow water lily, *Nuphar variegata*) in center of Coffee Swamp, a boreal rich fen on Washington Island, Wisconsin. Note abundant giant reed (*Phragmites australis*) in the foreground, and tamaracks (*Larix laricina*) and white cedar (*Thuja occidentalis*) in the background, 9 September 1998.



FIGURE 9. Vernal pond in mixed conifer-hardwood stand near north tip of Summer Island, Michigan. Northern manna grass (*Glyceria borealis*) is common in the pond, 28 May 1998.

Great Lakes Alkaline Rockshore and Alvar (Table 9)

Crevice, coastal, horizontal exposures of dolomite feature some of the richest, most floristically distinct, and aesthetically pleasing plant communities in the Grand Traverse Islands. These Great Lakes alkaline rockshores (Wisconsin Department of Natural Resources 1999) are influenced by wave-splash, ice-push, and the fluctuating levels of Lake Michigan. White cedar is almost always the dominant shoreline tree, and common associated shrubs are ninebark (*Physocarpus opulifolius*), red-osier dogwood (*Cornus stolonifera*), shrubby St. John's-

TABLE 9. Characteristic species of Great Lakes alkaline rockshores and alvars on the Grand Traverse Islands (*—found only on the Michigan islands).

<i>Agalinis purpurea</i>	<i>Iris lacustris</i>
<i>Anemone virginiana</i>	<i>Juncus alpinoarticulatus</i>
<i>Aquilegia canadensis</i>	<i>J. arcticus</i> subsp. <i>littoralis</i>
<i>Arabis hirsuta</i>	<i>J. brevicaudatus</i>
<i>Argentina anserina</i>	<i>Juniperus communis</i> var. <i>depressa</i>
<i>Aster ciliolatus</i>	<i>J. horizontalis</i>
<i>A. pilosus</i> var. <i>pringlei</i>	<i>Larix laricina</i>
<i>Calamagrostis inexpansa</i> subsp. <i>stricta</i>	<i>Lathyrus palustris</i>
<i>Calamintha arkansana</i>	<i>Lilium philadelphicum</i>
<i>Campanula rotundifolia</i>	<i>Lobelia kalmii</i>
<i>Carex aquatilis</i>	<i>Lycopus americanus</i>
<i>C. aurea</i>	<i>Lysimachia quadriflora</i>
<i>C. buxbaumii</i>	<i>Osmunda regalis</i> var. <i>spectabilis</i>
<i>C. capillaris</i> *	<i>Packera paupercula</i>
<i>C. castanea</i>	<i>Panicum acuminatum</i> (and varieties)
<i>C. concinna</i>	<i>Parnassia parviflora</i>
<i>C. crawei</i>	<i>Pentaphragmoides floribunda</i>
<i>C. eburnea</i>	<i>Physocarpus opulifolius</i>
<i>C. flava</i>	<i>Polygala senega</i>
<i>C. garberi</i>	<i>Populus balsamifera</i>
<i>C. granularis</i>	<i>Primula mistassinica</i>
<i>C. hystericina</i>	<i>Prunella vulgaris</i>
<i>C. richardsonii</i> *	<i>Rhynchospora capillacea</i>
<i>C. sterilis</i>	<i>Rosa acicularis</i> subsp. <i>sayi</i>
<i>C. viridula</i>	<i>Rudbeckia hirta</i>
<i>Castilleja coccinea</i>	<i>Selaginella eclipses</i>
<i>Cicuta bulbifera</i>	<i>Shepherdia canadensis</i>
<i>Comandra umbellata</i>	<i>Sisyrinchium montanum</i>
<i>Cornus stolonifera</i>	<i>Smilacina stellata</i>
<i>Deschampsia cespitosa</i>	<i>Solidago juncea</i>
<i>Eleocharis elliptica</i>	<i>S. ohioensis</i>
<i>E. quinqueflora</i>	<i>Sphenopholis intermedia</i>
<i>Equisetum arvense</i>	<i>Symphoricarpos albus</i>
<i>E. variegatum</i>	<i>Thalictrum dioicum</i>
<i>Eupatorium perfoliatum</i>	<i>Thelypteris palustris</i> var. <i>pubescens</i>
<i>Euthamia graminifolia</i>	<i>Thuja occidentalis</i>
<i>Fragaria virginiana</i>	<i>Tofieldia glutinosa</i>
<i>Gentianopsis procera</i>	<i>Triglochin palustre</i>
<i>Geum aleppicum</i>	<i>Vicia americana</i>
<i>Hieracium kalmii</i>	<i>Viola adunca</i>
<i>Houstonia longifolia</i> *	<i>V. nephrophylla</i>
<i>Hypericum kalmianum</i>	<i>Zigadenus elegans</i> subsp. <i>glaucus</i>



FIGURE 10. Great Lakes alkaline rockshore on east coast of Summer Island, Michigan. Common shrubs are ninebark (*Physocarpus opulifolius*) and shrubby cinquefoil (*Pentaphylloides floribunda*), 27 May 1998.

wort (*Hypericum kalmianum*), and shrubby cinquefoil (*Pentaphylloides floribunda*). Table 9 presents the long list of species that are characteristic of this community. Most noteworthy are dwarf lake iris, bird's-eye primrose, low calamint, Ohio goldenrod, silverweed, frost aster (*Aster pilosus* var. *pringlei*), tufted hairgrass (*Deschampsia cespitosa*), lesser fringed gentian (*Gentianopsis procera*), narrow-leaved loosestrife (*Lysimachia quadriflora*), meadow spike-moss (*Selaginella eclipses*), and northern bog (or alvar) violet (*Viola nephrophylla*). Examples of this community may be found along the extreme southeast coast of Washington Island and the south tip of Detroit Island. Based on collections made in 1905, it is likely that Spider Island once had this community (it has now been lost to colonial waterbirds). The Michigan islands have this community in those places where true alvar (see the following paragraph) is not present, including Little Summer and St. Martin Islands.

Alvar is a globally rare plant community (Soule 1993; Albert *et al.* 1995, 1997; Penskar *et al.* 1999; Reschke *et al.* 1999) that occurs only in Scandinavia and the Great Lakes region of the United States and Canada. This community has been described as having the following characteristics (Reschke *et al.* 1999): It occurs on horizontal limestone or dolomite with thin soils; is a naturally open, treeless landscape; is subject to seasonal drought and flooding; is beyond the reach of Great Lakes waves and ice; and has a distinctive set of plant species and vegetational patterns. Based on 1995 field work by Michael R. Penskar and Patrick J. Comer of the Michigan Natural Features Inventory, it appears that a



FIGURE 11. Creeping juniper—shrubby cinquefoil alvar pavement on east coast of Summer Island, Michigan. The common trees are white cedar (*Thuja occidentalis*) and balsam fir (*Abies balsamea*), 27 May 1998.

subtype known as “Creeping Juniper—Shrubby Cinquefoil Alvar Pavement” (Reschke *et al.* 1999: 26–29) occurs on the eastern coasts of both Poverty and Summer Islands, Michigan, as well as much more extensively on the Garden Peninsula to the north. This subtype, as represented on the Grand Traverse Islands, is less diverse than elsewhere in the Great Lakes region such as on Manitoulin Island and the Bruce Peninsula of Ontario, lacking such species as northern singlespike sedge (*Carex scirpoidea* Michx.), upland white aster (*Solidago ptarmicoides* (Torr. & A. Gray) Boivin), and lakeside daisy (*Hymenoxys herbacea* (Greene) Cusick). However, the Poverty and Summer Islands alvars do have Richardson’s sedge (*Carex richardsonii*), which is rare in Door County, Wisconsin. The alvars have nearly all of the same species as the more widespread Great Lakes alkaline rockshore. On the north coast of Summer Island about 1 km northwest of Summer Harbor there is an additional small area of very wet alvar with seepage, small rocks pools, and tamarack (*Larix laricina*) present along with the cedars. It is also possible that the southeast coast of St. Martin Island may harbor an alvar community; surveys are needed there.

A peculiar type of alkaline lakeshore is present in the Grand Traverse Islands for which I will coin the term “Great Lakes sparse marshes.” This wetland type occurs wherever there are very sheltered bays or coves with shallow water and an accumulation of calcareous mud, gravel, or cobbles. These meadows are dominated by discontinuous combinations of the following species: water sedge (*Carex aquatilis*), Baltic rush, silverweed, softstem bulrush (*Schoenoplectus*

tabernaemontani), and variegated scouring-rush (*Equisetum variegatum*). As the name implies, there is much bare marl or gravel between individual plants. The best examples of this type in the archipelago are on the east coast of Little Summer Island (Figs. 37, 50), the southwest bay of Summer Island (Fig. 36), the north bay between Richter and Rabbitt Points on Detroit Island, "Carp Lake" on Plum Island (Fig. 22), and in some of the shallow bays on Washington Island (West Harbor, Figenscaus Harbor, and Detroit Harbor).

"Cedar cobble glades" (Fig. 40) are uncommon community subtypes consisting of piles and "windrows" of dolomite gravel and cobbles among which grow scattered trees of white cedar, with little other vegetation (Albert *et al.* 1997). In the Grand Traverse Islands, this association is found on the west coast of Little Summer Island, and along the north coast of Washington Island west of the "outlet" of Coffee Swamp.

Coastal Dry Cliffs

High (to 40 meters or more), sheer, white, essentially dry coastal dolomite bluffs occur on the west coasts of three of the Grand Traverse Islands: Washington (from Boyer Bluff south), Rock (most of the western and northern coasts), and St. Martin (west coast; Fig. 12). Here, white cedar is the dominant and oftentimes the only tree species present, although balsam fir may also occur, and there may be an understory of mountain maple (*Acer spicatum*). Understory associates that grow on the lip of the cliff include ebony sedge, white camass, buffaloberry, rock whitlow-grass (*Draba arabisans*), climbing fumitory (*Adlumia fungosa*), hairy rock-cress (*Arabis hirsuta*), rough goldenrod (*Solidago hispida*), big-leaved aster, wild sarsaparilla, and the feathery moss *Hylocomium splendens*. All of these can be viewed along the steps leading down to the beach at Potawatomi Lighthouse on Rock Island. These high cliffs often occur as a series of stepped shelves or terraces, that were carved by a varying series of post-glacial lake levels.

Interior Moist Cliffs (Table 10)

A much different type of dolomite cliff is found in the interiors of Washington Island (Boyer Bluff and Mountain Tower Park, the latter site a good place to view this community), and especially Rock Islands. Here, the actual "cliff" is relatively low, only several meters high, but it is eroding/dissolving because of lateral seepage of ground water, and a large dolomite scree apron has developed at its base. The forest overstory is one of white cedar, sugar maple, and balsam fir, often with a dense mountain maple (*Acer spicatum*) subcanopy. The scree apron is often lushly vegetated with ferns of the genera *Cystopteris* and *Dryopteris*, especially bulblet fern (*C. bulbifera*) and marginal wood fern (*D. marginalis*). Rank-smelling herb-Robert (*Geranium robertianum*) and climbing fumitory are characteristic of this habitat. Large, detached, fallen dolomite boulders may be covered with mosses and walking fern (*Asplenium rhizophyllum*), and, in crevices or in shelves of the cliff, may be found Canada yew, slender cliff brake (*Cryptogramma stelleri*), and green spleenwort (*Asplenium*



FIGURE 12. Dolomite cliff (topped with white cedar) on west coast of St. Martin Island, Michigan, 24 July 1990. Similar cliffs are found on the northeast sides of Washington and Rock Islands. Photograph courtesy of Thaddeus A. Grudzien, Oakland University.

TABLE 10. Special plants of moist cliffs of the Grand Traverse Islands.

<i>Adlumia fungosa</i> (Little Strawberry, Horseshoe, Plum, Detroit, Pilot, Washington, Rock, St. Martin, Little Gull, Gull, Summer, and Little Summer Islands)
<i>Asplenium rhizophyllum</i> (Rock Island)
<i>A. trichomanes</i> (Washington Island)
<i>A. trichomanes-ramosum</i> (Washington Island)
<i>Cryptogramma stelleri</i> (Washington, Rock, St. Martin, and Summer Islands)
<i>Cystopteris bulbifera</i> (Detroit, Washington, Rock, and Summer Islands)
<i>C. laurentiana</i> (St. Martin and Summer Islands)
<i>C. tenuis</i> (many islands)
<i>Dryopteris expansa</i> (Rock Island)
<i>Dryopteris marginalis</i> (Plum, Detroit, Washington, and Rock Islands)
<i>Gymnocarpium dryopteris</i> (many islands)
<i>Pellaea glabella</i> (St. Martin and Summer Islands)
<i>Polypodium virginianum</i> (many islands)
<i>Taxus canadensis</i> (cliffs only: Washington, Rock, and Summer Islands).

trichomanes-ramosum). In areas with a more deciduous tree canopy that allows sunlight to reach the forest floor during May, spring ephemerals such as dutchman's-breeches and bishop's-cap (*Mitella diphylla*) may be locally common on moist cliff shelves or in "grottos" where some soil has accumulated, such as on eastern Rock Island and on Detroit Island.

"Bird Islands" (Figs. 13, 16–18, 24, 42, 55)

These are small (less than 10 ha) islands in Green Bay and Lake Michigan that have recently (since 1980) been invaded by, and had their arboreal vegetation destroyed by, the urea of nesting colonial waterbirds, principally Herring and Ring-Billed Gulls and Double-crested Cormorants. Before avian invasion, these islands were typically forested with white cedar, white birch, balsam fir, and basswood. After the tree kill, berried, bird-dispersed shrubs became dominant: red-berried elder (*Sambucus racemosa* subsp. *pubens*), red raspberry, red-osier dogwood, wild black currant (*Ribes americanum*), juneberries (*Amelanchier* spp.), and bittersweet nightshade (*Solanum dulcamara*). The understory consists of rank native and exotic herbs such as catnip (*Nepeta cataria*), motherwort (*Leonurus cardiaca*), lamb's-quarters (*Chenopodium album*), cheeses (*Malva neglecta*), nettles (*Urtica dioica* subsp. *gracilis*), fringed bindweed (*Polygonum cilinode*), thistles (*Cirsium* spp.), and some grasses such as fowl meadow grass (*Poa palustris*).

Anthropogenic Communities and Threatening Exotic Species (Table 11)

Numerous old fields and pastures are found on Washington Island and represent the dominant anthropogenic or "human-created" plant communities on the islands. In such sites, exotic forage grasses such as timothy (*Phleum pratense*) and the bluegrasses (particularly *Poa compressa* and *P. pratensis*) may be dominant, along with interesting exotic forbs such as viper's bugloss (*Echium vulgare*). If mowed infrequently or mowed after nesting season, such open areas may be important habitat for grassland birds.



FIGURE 13. "White-washed" dolomite ledges on east coast of Pilot Island, Wisconsin. Note Double-crested Cormorants and gulls, 22 July 1999.

Island forests face a number of threats from exotic plant species. The European helleborine (*Epipactis helleborine*) is our only weedy orchid and appears to be becoming commoner in nearly all mesic and wet-mesic forest communities. A much greater threat is garlic mustard (*Alliaria petiolata*) which has appeared on both Washington and Rock Islands in recent years. This herb is a prolific producer of tiny, long-lived seeds and may take over and destroy the native herbaceous understory of rich mesic forests in the Midwest. For years it has been marching north and is now a dominant in woods in Peninsula State Park on the Door Peninsula. Its spread may be attributed to vehicle traffic (including logging

TABLE 11. Pernicious exotic weeds of the Grand Traverse Islands.

<i>Alliaria petiolata</i> (mesic forests: Horseshoe, Washington, and Rock Islands)
<i>Centaurea biebersteinii</i> (dunes: Green, Chambers, Plum, Detroit, Washington, Rock, and Summer Islands)
<i>Cynoglossum officinale</i> (dolomite cliffs, woods: Chambers, Cana, Horseshoe, Plum, Detroit, Washington, Rock, Poverty, Summer, and Little Summer Islands)
<i>Epipactis helleborine</i> (mesic forests: Chambers, Plum, Detroit, Washington, Rock, and Little Summer Islands)
<i>Lythrum salicaria</i> (rare, dune swale, Chambers Island)
<i>Rhamnus frangula</i> (spreading in Coffee Swamp, Washington Island)
<i>Sedum acre</i> (shores: Cana, Chambers, Detroit, Washington, Rock, St. Martin, Gravelly, Gull, Poverty, Summer, and Little Summer Islands)
<i>Veronica anagallis-aquatica</i> (shorelines: Cana, Hat, Plum, Detroit, Washington, Poverty, Summer, and Little Summer Islands)



FIGURE 14. Old pasture on ancient dolomite gravel beach ridge along Lakeview Road, Washington Island, Wisconsin. The pasture is being invaded by common juniper (*Juniperus communis* var. *depressa*), shrubby St. Johnswort (*Hypericum kalmianum*), common milkweed (*Asclepias syriaca*), and Indian paint-brush (*Castilleja coccinea*). Note deer browse line on white cedars, 21 July 1999.

equipment) and, ironically, otherwise environmentally aware hikers and campers who inadvertently introduce the seeds on boots and in tents from farther south. The next stop on a Door County holiday camping pilgrimage after Peninsula State Park is often Rock Island State Park, and indeed garlic mustard was first detected there on a tent pad in 1997.

On dunescapes, spotted knapweed (*Centaurea biebersteinii*) may be a common and essentially ineradicable threat. It has become so over the last 40 years near the airstrip on Chambers Island in 1998 (it was not collected by Ugent in 1961).

Dolomite cliff plant communities are threatened by the proliferation of common hound's-tongue (*Cynoglossum officinale*), a coarse herb with burlike fruits that are abundantly dispersed on clothing—or on the fur of deer. It is locally common on many dolomite cliffs, as well as in mesic woods that have been disturbed by heavy cutting or high deer populations.

Great Lakes shoreline wetlands have two pernicious invaders of their own: Gold-moss stonecrop (*Sedum acre*) and water-speedwell (*Veronica anagallis-aquatica*). Efforts towards eradication of the stonecrop are not helped by the fact that many people find it an attractive plant, much like purple loosestrife (*Lythrum salicaria*). The latter species is fortunately as yet rare in the island chain. Another wetland plant that poses a threat is glossy buckthorn (*Rhamnus*

frangula), which appears to be spreading in Coffee Swamp on Washington Island.

FLORISTICS AND BIOGEOGRAPHY

The Grand Traverse Islands (GTI) have a vascular flora of 797 species (in an area of 9340 ha), a figure that represents about one-third of Wisconsin's flora. Exotics account for 161 species or about 20% of the flora. The archipelago has almost exactly the same number of plant species as the 16,200 ha Apostle Islands archipelago (Judziewicz & Koch 1993, Judziewicz 1996), even though it is 40% smaller by area.

It is interesting that there are no vascular plants found on the GTI that are found nowhere else in Wisconsin. By comparison, the Apostle Islands have eight such species. However, there are several GTI species known from only a few state sites: northern comandra (*Geocaulon lividum*), dune willow (*Salix cordata*), and flat-leaved wood sedge (*Carex platyphylla*). The first two are both present at Jackson Harbor on Washington Island, and each has only one other Wisconsin station, the comandra at The Ridges in mainland Door County, and the willow from Point Beach State Forest in Manitowoc County. The sedge is known from several sites on the peninsula south to Sturgeon Bay.

Boreal elements (Table 6) are important in only a few places on the islands, most notably Jackson Harbor Ridges on Washington Island, where disjuncts such as the northern comandra are found. The Coffee Swamp and Big Marsh areas are also fen/conifer swamp complexes with a boreal element including such species as tufted bulrush (*Scirpus cespitosus*), false asphodel (*Tofieldia glutinosa*), alpine cotton-grass (*Eriophorum alpinum*), northern bog sedge (*Carex gynocrates*), and northern black currant (*Ribes hudsonianum*). Indeed, these inland calcareous wetlands often have more northern species than any coastal area. Following the list of Given & Soper (1981), the archipelago flora has six arctic-alpine species, namely slim-stemmed reed-grass (*Calamagrostis stricta* subsp. *expansa*), hairlike sedge (*Carex capillaris*), tufted bulrush, marsh ragwort (*Senecio congestus*, apparently extirpated), bird's-eye primrose (*Primula mistassinica*), and Lake Huron tansy (*Tanacetum huronense*, apparently extirpated); and four western disjunct Cordilleran species (Marquis & Voss 1981), namely western fescue (*Festuca occidentalis*), green-leaved rattlesnake-plantain (*Goodyera oblongifolia*), Chilean sweet-cicely (*Osmorhiza berteroi*), and thimbleberry (*Rubus parviflorus*). The Apostle Islands are one species poorer in each of these two categories (Judziewicz & Koch 1993: Table 4) than the GTI.

The moderating effects of Lake Michigan (cool summers, mild winters) favor the persistence of southern and eastern species in the islands' beech-sugar maple forests (Tables 4–5). The most noteworthy disjunct from the east is flat-leaved sedge (*Carex platyphylla*), overlooked until recently from several sites on Washington and Rock Islands. The species is also known from the Door Peninsula north of Sturgeon Bay, but not from the Garden Peninsula or elsewhere in the Upper Peninsula of Michigan. It is tempting to think of this species and others

such as butternut (*Juglans cinerea*), Virginia waterleaf (*Hydrophyllum virginianum*), hairy-leaved sedge (*Carex hirtifolia*), and wood phlox (*Phlox divaricata* subsp. *laphamii*) as relicts of the warm post-glacial "Xerothermic" period of about 3,500 years B.P. (Curtis 1971). A similar effect has been postulated for high Oak Island in the Apostles archipelago, which curiously has several slightly to greatly disjunct species in common with the GTI, namely witch hazel (*Hamamelis virginiana*), wild licorice (*Galium lanceolatum*), and drooping sedge (*Carex prasina*).

Certain southern mesic species do appear to "drop out" at the watery Wisconsin-Michigan state line north of Rock Island. Examples are (among others) blue cohosh (*Caulophyllum thalictroides*), black-seeded rice-grass (*Oryzopsis racemosa*), yellow trout-lily (*Erythronium americanum*), pagoda dogwood (*Cornus alternifolia*), larger enchanter's-nightshade (*Circaea lutetiana* subsp. *canadensis*), and lopseed (*Phryma leptostachya*). Their absence from the Michigan islands may be the result of simply the stochastic effects of island size and distance from source colonies, or there may be compounding factors such as poorer soil, a more severe fire history, and higher deer populations. Then, too, St. Martin Island has never been surveyed for its spring flora, which gives hints of being locally rich.

Several wetland species are somewhat disjunct from farther south, in the interior wetlands of Washington and St. Martin Islands: false mermaid (*Proserpinaca palustris* var. *crebra*), yellow water buttercup (*Ranunculus flabellaris*), and running marsh sedge (*Carex sartwellii*). They often occur on the margins of fluctuating vernal ponds and swamps that are surrounded by black ash (*Fraxinus nigra*) and/or white cedar.

The richness or rarity of the GTI flora should not be over-emphasized, however. Many of the islands in the Beaver, Manitou and Fox Island groups 75–100 km to the east and northeast in northern Lake Michigan harbor numerous northern, eastern, and southern species not known from the GTI, or, in some cases, anywhere in Wisconsin (Guire & Voss 1963; Marquis & Voss 1981; Hazlett 1991, 1993; Albert *et al.* 1997; Penskar *et al.* 1999). On these islands, hypermesophytes such as three species of holly ferns (*Polystichum* spp.), blue-stemmed goldenrod (*Solidago caesia* L.), great waterleaf (*Hydrophyllum appendiculatum* Michx.), and purple trillium (*Trillium erectum* L.) "rub elbows" (or at least occur on the same island) with northern species such as calypso orchid, northern commandra, butterwort (*Pinguicula vulgaris* L.), and Smith's melic grass (*Melica smithii* (A. Gray) Vasey), and prairie/dune species such as small green milkweed (*Asclepias viridiflora* Raf.), prairie dunewort (*Botrychium campestre* W.H. Wagner & Farrar), junegrass (*Koeleria macrantha* (Ledeb.) Schult.), and clustered cancer-root (*Orobanche fasciculata* Nutt.). There are probably two reasons for this: The more complex, higher, more extensive, and microhabitat-rich dune systems present in the Beaver-Manitou-Fox archipelago; and their more maritime climate given that they are much further from the mainland and thus more climatically buffered than the GTI. When more complete florulas are available for the Beaver-Garden-High-Hog Island chain in Michigan, we will be able to compare it with the GTI in more detail.

Just to the north and northeast of the GTI is the Garden Peninsula and exten-

sive Great Lakes dune ridge-and-swale communities that stretch away east along the shoreline towards the Straits of Mackinac. The Garden Peninsula has much more extensive alvar than the GTI, an aggregate of over 100 ha (Albert *et al.* 1997), and high dolomite cliffs on the west coast such as Burnt Bluff. From Thompson and Manistique and east, the Michigan dune systems have relatively numerous, viable populations of Pitcher's thistle (*Cirsium pitcheri*) and Lake Huron tansy (*Tanacetum huronense*), as well as the Great Lakes endemic Houghton's goldenrod (*Solidago houghtonii* A. Gray), which does not occur in Wisconsin. Rare boreal species such as plains ragwort (*Packera indecora* (Green) A. Löve & D. Löve), intermediate poverty oatgrass (*Danthonia intermedia* Vasey), and veined meadow-rue (*Thalictrum venulosum* Trel.) are also found along this stretch of coast not too far from the GTI.

To the south, the Door Peninsula proper boasts many communities that are much better developed than on the islands, and rare species that do not occur there. Newport State Park, the Mink River estuary, Toft Point, the Carlsville Bluffs, The Ridges, Toft Point, and Kangaroo Lake (Palmquist *et al.* 1991) are all complex, interesting sites, but their floristics fall outside the purview of this paper. Suffice it to say here that there are several northern and western disjunct plants that "skip over" the GTI and occur on the Door County mainland. Notable among these are giant pinedrops (*Pterospora andromedea* Nutt.), common moonwort (*Botrychium lunaria* L.), northern gooseberry (*Ribes oxycanthoides* L.), coast sedge (*Carex exilis* L.), and white mandarin (*Streptopus amplexifolius* (L.) DC.

The bird islands of Green Bay and Lake Michigan host a weedy flora of both native and exotic herbs and shrubs. Many of the shrubs are bird-dispersed (Hogg & Morton 1983), such as red-berried elder (*Sambucus racemosa* subsp. *pubens*) and wild black currant (*Ribes americanum*), while others are common rank exotic herbs that thrive in the nutrient-rich soils of such islets, for example moth-erwort (*Leonurus cardiaca*) and catnip (*Nepeta cataria*). It is curious to note, though, the presence of mesic herbs of the genera *Dicentra* and *Erythronium* on several of the smaller, remoter isles (Hat Island, Little Strawberry Island). Again, there is a parallel with the Apostle Islands, where *D. cucullaria* was recorded from tiny Gull Island (Judziewicz & Koch 1993), and not on any other island in that archipelago.

Chambers Island in central Green Bay has a climate with warmer summers than the GTI proper, and a different physiognomy not based on the presence of dolomite near the surface. About two dozen species of prairie grasses, forbs, and even shrubs (Table 8) are found in the pine barrens and coastal dunes of the northern part of the island. Some of these taxa (for example needle grass, *Stipa spartea*) are rare elsewhere else along the shores of northern Lake Michigan. The Chambers Island barrens have strong sand prairie and pine barrens floristic affinities, and such communities occur or occurred not far from the western shore of Green Bay near the cities of Menominee, Michigan and Marinette, Wisconsin. Perhaps wind or waves dispersed many of these species about 20 miles northeast from there to Chambers Island. The only other spot in the archipelago with even a hint of a prairie flora is the Jackson Harbor Ridges dune complex, which has four prairie or barrens species: Little bluestem

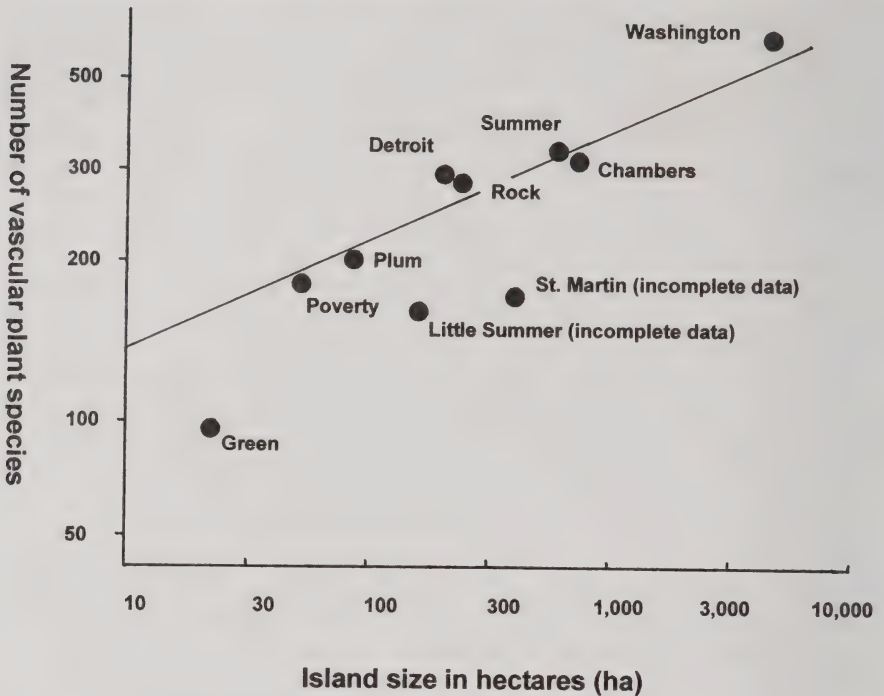


FIGURE 15. Vascular plant species/area curve for the Grand Traverse Islands, with least-squares fitted regression line.

(*Schizachyrium scoparium*), sand drop seed (*Sporobolus cryptandrus*), smooth aster (*Aster laevis*), and a historical record of prairie cinquefoil (*Potentilla arguta*).

The rich floras of certain interior shaded dolomite cliffs (Table 11), such as those on Washington Island (Boyer Bluff, Mountain Tower Park) and Rock Island (most interior scarps) have been discussed earlier in this paper.

When a species/area curve (Fig 15) is plotted for the larger, well-surveyed GTI (Chambers, Plum, Detroit, Washington, Rock, Poverty, and Summer Islands), it will be seen that the slope of the curve is nearly identical to that of the Apostles Islands curve (Judziewicz & Koch 1993: 72), but the y-intercept is about 10% higher. (Therefore, an island of a given size in the GTI will have a flora 10% higher than one of similar size in the Apostles). An obvious main explanation for this greater richness suggests itself: The more nutrient-rich dolomite-derived soils of the GTI, as opposed to the acidic, sandstone-derived nutrient-poor soils of the Apostle Islands. Another diversity "edge" for the GTI may be their "bimodal" forest composition. Pre-settlement survey notes show that the larger islands such as Washington had beech-maple dominated interiors, with about a one-half mile wide coastal fringe of mixed cedar, hemlock, spruce, and balsam fir forest. The forests in Mountain Tower Park, for example, are quite different from those along Jackson Harbor. In contrast, the forests of the

Apostle Islands (with the notable exceptions of Long and Oak Islands) were pretty much homogeneous mixtures of hemlock, white pine, white cedar, sugar maple, balsam fir, and yellow birch, and there was not as much differentiation between edge and center of island as in the GTI. Another edge that the GTI have is their relative continentality. The chain is dominated by Washington Island, which accounts for 62% of the archipelago's area, versus Madeline Island in the Apostles which accounts for only 27% of that archipelago's area. Finally, the GTI occurs about 1° farther south than the Apostle Islands, and diversity is generally greater at lower latitudes (of course, this begs the question of why!). The Apostles would appear to have the edge on the GTI in two other diversity-promoting factors: The absence (except on Madeline Island) of large numbers of scenery-chomping white-tailed deer, which appear to have contributed to a dearth of lilies and orchids in the understories of all the larger GTIs; and the much better-developed sandscape/wetland complexes such as those on Stockton, Madeline, and Outer Islands (only Washington and Chambers Islands have analogously large wetlands in the GTI).

ISLAND-BY-ISLAND SUMMARIES

The following summaries attempt to give an impression of the flora, vegetation, and a bit of the human cultural context of each island. The General Land Office survey notes (1830s and 1840s) were consulted for each of the Wisconsin islands, as were the 1942–1944 Wisconsin Department of Agriculture land cover maps (also known as the “Bordner Survey”). Starting in the 1960s and 1970s, Wisconsin Department of Natural Resources (WDNR) biologists began surveying these islands, and much of their data has been drawn upon. Finally, my WDNR surveys were conducted from September 1997 through August 1999. Arrangement of presentation of islands is from south to north.

Snake Island, Wisconsin

This small (11 ha), privately-owned island is located just of the Green Bay coastline a few miles south of the entrance to Sturgeon Bay Ship Canal. It has an almost “atoll”-like physiography and is also known as Basin Island. There is an “outer” rim of higher ground, cored by dolomite that outcrops as 2 m high ledges at the north end, forested with scattered trees of white cedar, basswood, balsam-poplar, box-elder, and some white birch, quaking aspen, and green ash. Here, Dutchman's-breeches (*Dicentra cucullaria*) makes a showy understory display in the spring. The “rim” of the basin surrounds a sedge meadow/emergent aquatic marsh of sedges, bulrushes, blue vervain (*Verbena hastata*), orange jewelweed (*Impatiens capensis*), cattails, arrowhead (*Sagittaria latifolia*), and Canada bluejoint. In years of normal Lake Michigan water levels, this meadow is flooded (it was dry in 2000). It is interesting to note that although Snake Island is only 1/3 the size of Green Island, it has 50% more plant species, probably because of the greater diversity of wetland habitats on the former island.



FIGURE 16. View west from east tip of Green Island, Wisconsin. Dominant shrub on dolomite gravel and cobbles is red-berried elder (*Sambucus racemosa* subsp. *pubens*). Note light tower at site of ruined lighthouse, and nesting gulls, 8 June 1998.

Green Island, Wisconsin (Figs. 16–18)

Green Island, the only island in northern Green Bay that is a part of Marinette County, is located about 7 km southeast of the city of Marinette. It is a partially wooded 32 ha sandbar that is 1.4 km long, 0.3 km wide, and rises to a maximum height of only 7 m above Lake Michigan. There are no wetlands, so the flora is poor, with less than 100 species recorded during two visits in 1998 and 1999. This was apparently the first botanical survey of the island. The vegetation has been highly modified by past human activities, and, to a lesser extent nesting gulls, Black-crowned Night-Herons, and Common Egrets. At the eastern tip are the remains of a lighthouse, abandoned decades ago and then, more recently, burned by vandals (Pleger 1992). The ruins are covered by rank growths of staghorn sumac (*Rhus hirta*) and poison-ivy (*Toxicodendron rydbergii*). Near the south coast are a series of brushy stabilized dunes dominated by quaking aspen (*Populus tremuloides*), chokecherry (*Prunus virginiana*), poison-ivy, staghorn sumac, starry false Solomon's-seal (*Smilacina stellata*), sheep sorrel (*Rumex acetosella*), Canada bluegrass (*Poa compressa*) and cheatgrass (*Bromus tectorum* var. *glabratus*); the barrens sedge *Carex muhlenbergii* is occasional. The western one-third of the island has a remnant boreal forest, with balsam fir dominant in the overstory and Canada yew in the understory. The presence of abundant yew is noteworthy and indicates that deer do not visit this island; Adventure Island (Wisconsin) and Poverty Island (Michigan) are the only other Grand Tra-



FIGURE 17. View east from east tip of Green Island, with bluffs of Door Peninsula on the horizon, 8 June 1998.



FIGURE 18. View east from west tip of Green Island, 8 June 1998. John Huff is on the left; on the right horizon is the light tower on the opposite end of the island.

verse Islands to have healthy yew populations in the archipelago. Other tree species present are white birch, basswood, quaking aspen, and some white cedar, white spruce and white pine. Mesic forest herbs including great-flowered trillium (*Trillium grandiflorum*), hairy sweet cicely (*Osmorhiza claytonii*), and jack-in-the pulpit (*Arisaema triphyllum*) are common in the understory, and even herb-Robert (*Geranium robertianum*), a refugee from the dolomitic Door Peninsula, is present.

Cana Island, Wisconsin

Canan Island is located just off the coast of the Lake Michigan shoreline a few miles northeast of the village of Baileys Harbor. It is barely an island at all, because it is periodically connected to the mainland by a driveable causeway during periods of low lake levels. This 2–3 ha island is dominated by a white cedar forest, but there is a maintained clearing around the restored lighthouse (built in 1869–1870) at the southeast end. Many exotics are present, deer browsing is heavy, and the forest understory is somewhat disturbed. The shoreline consists of low dolomite shelves, and one rare plant species is present.

Hat Island, Wisconsin (Fig. 55)

Hat Island is a tiny (less than 1 ha) low island in Green Bay located 5 km from the mainland midway between Egg Harbor and Fish Creek. It is currently a breeding ground for gulls and Double-crested Cormorants, and was visited on 6 May 1998 with U.S. Fish and Wildlife Service personnel (we also visited Adventure, Little Strawberry, Jack, and Horseshoe Island that day). Hat Island was recently forested, since there are a few eerily skeletal dead cottonwoods (*Populus deltoides* subsp. *monilifera*) still standing, and a small colony of dutchman's-breeches (*Dicentra cucullaria*) at the highest point. Red raspberry (*Rubus idaeus* var. *strigosus*), wild black currant (*Ribes americanum*), chokecherry, and red-berried elder (*Sambucus racemosa* subsp. *pubens*) are frequent shrubs, while weedy exotics such as motherwort (*Leonurus cardiaca*) and catnip (*Nepeta cataria*) dominate the groundlayer.

Chambers Island, Wisconsin (Figs. 7, 19, 20, 41, 45–47; Table 8)

The second-largest of Wisconsin's Lake Michigan Islands, Chambers Island is located about 8 km northwest of Fish Creek and 10 km from the Michigan shoreline. It is a low flat island composed of sand, clay and gravel, with a maximum elevation of only 17 m above Green Bay. The island has 11 km of town roads, a private airstrip, over 40 seasonal homes, a historic lighthouse (the only public land on the island), and the Holy Name Retreat House, operated by the Diocese of Green Bay. Although the underlying bedrock is mapped as Silurian dolomite, it is nowhere exposed on the island and the sandy-clayey soils give general indications of being nutrient-poor and somewhat acidic. In general the topography and flora of Chambers Island is more similar to that of Marinette County than the Door Peninsula, although a few calciphiles such as buffaloberry

Chambers Island



FIGURE 19. Map of Chambers Island, Wisconsin.



FIGURE 20. Older second-growth forest of hemlock (*Tsuga canadensis*), sugar maple (*Acer saccharum*) and beech (*Fagus grandifolia*) along Baseline Road on southeastern Chambers Island, Wisconsin, 9 May 1998. This is quite close to the spot on the road where a 12" d.b.h. red maple fell on the author several weeks later.

(*Shepherdia canadensis*) and herb-robert do occur on the island where aprons of dolomite gravel from the Door Peninsula wash up. Although Norman C. Fassett apparently made a few collections near the lighthouse in 1935, the only other botanical visits prior to mine were those of Donald Ugent, who visited Chambers Island several times during the summer of 1961 and collected several hundred numbers. Don, now a professor of botany at Southern Illinois University, recalls that he worked at the agricultural experiment station on the mainland (researching potatoes, then as now), and hopped the then-public ferry to the island whenever he could.

Several aspects of the natural history of Chambers Island are noteworthy: Its fine regrown hemlock-hardwood forests; current absence of white-tailed deer; remnant Great Lakes pine barrens communities with a strong prairie element; and relatively undisturbed Great Lakes beach flora.

About $\frac{3}{4}$ of Chambers Island is forested with a mix of 12–24" second- and third-growth beech, sugar maple, red oak, and hemlock. General Land Office (GLO) notes from the initial 1835 survey (Table 3) indicate that "pine" (mainly white pine) and "black oak" (presumably red oak, *Quercus rubra*) had a combined importance value of 60% on the island. These were followed by hemlock (12%), beech and sugar maple (both 7%) and basswood (3%).

In 1998, in the southwest, beech is dominant (Fig. 46); along Baseline Road, there is a mix of hemlock, beech and sugar maple (Figs. 20, 41); and in the north,

red oak is locally dominant, sometimes mixed with bitternut hickory (*Carya cordiformis*). The shrub and herb groundlayer in these forests is generally poor, with few ephemerals; violets (*Viola* spp.) and wood anemone (*Anemone quinquefolia*) are the commonest herbs in hemlock-hardwoods. The red oak woods, best developed on the road to Sand Point (Fig. 47), have a few characteristic species such as hog-peanut (*Amphicarpaea bracteata*), wide-leaved panic grass (*Panicum latifolium*), smooth aster (*Aster laevis*), and pale vetch (*Lathyrus ochroleucus*). The lighthouse (built in 1868) at the north end of the island has some of the finest spring wildflower displays on the island, with great-flowered trillium, great-flowered bellwort (*Uvularia grandiflora*), and other liliaceous herbs common. Along Baseline Road in the exact center of the island are a few trees of bur oak (*Quercus macrocarpa*) and a clone of mayapple (*Podophyllum peltatum*).

The island forests are unusual in a number of ways. They are selectively logged every 15 years (they were entered in 1999), and there are few exotic plants in the understory (about the only weed is helleborine orchid, *Epipactis helleborine*). Low-specification logging roads do not disrupt the continuous canopy with open corridors that would allow the entry of cowbirds which might parasitize less common forest birds. Deer had a devastating effect on plant survival and regeneration on the island from the 1940s through the 1980s; local residents said that you could see a half mile through the woods because the understory was so open. But they have now been absent for over ten years, resulting in fine regeneration of sugar maples and conifers.

The sandscapes on Sand Point and the North Bay harbor remnants of a Great Lakes barrens community (Fig. 7) found nowhere else on Wisconsin's Lake Michigan coast, and may represent the best examples of this community of anywhere in the state—the barrens on Stockton Island in the Apostle Islands do not have a prairie component (Judziewicz & Koch 1993). GLO notes confirm a very open forest even in 1835 with scattered trees of pine. Along with juniper species (*Juniperus communis* var. *depressa* and *J. horizontalis*) and beachgrass (*Amphiphila breviligulata*), and among scattered white and red pines (*Pinus strobus* and *P. resinosa*), grow prairie elements such as big and little bluestem (*Andropogon gerardii* and *Schizachyrium scoparium*), Indian-grass (*Sorghastrum nutans*), needle-and-thread grass (*Stipa spartea*), Muhlenberg's sedge (*Carex muhlenbergii*), New Jersey tea (*Ceanothus* spp.), butterflyweed (*Asclepias tuberosa* subsp. *interior*), blazing-star (*Liatris aspera*), hoary puccoon (*Lithospermum caroliniense* subsp. *croceum*), and the abundant smooth aster. Many grow nowhere else in the Door Peninsula or the Grand Traverse Islands (Table 8). However, the aggressive exotic spotted knapweed (*Centaurea biebersteinii*)—which was not collected by Ugent in 1960—is also common. These barrens clearly have affinities with sandy pine and oak barrens on the Wisconsin and Michigan mainland on the west side of Green Bay, such as, for example, the Ansel Dunes (now largely destroyed) that occurred on the outskirts of the city of Marinette. It seems reasonable to hypothesize that the prairie element on Chambers Island was dispersed there by water from these mainland areas.

A related community, Great Lakes beaches, occurs on three parts of the island. The dominants in this habitat are cocklebur (*Xanthium strumarium*), an

evening-primrose (*Oenothera* sp.), a knotweed (*Polygonum ramossimum*), and significant populations of the Wisconsin special concern species American sea-rocket (*Cakile edentula*) and seaside spurge (Fig. 45; *Chamaesyce polygonifolia*). Elsewhere on Wisconsin's Lake Michigan shoreline, these species have apparently suffered steep declines since they are vulnerable to greatly increased levels of human vehicle and foot traffic. Even in parks and state natural areas, it is difficult to keep people from trampling on a plant as humble as seaside spurge; but on Chambers Island low usage and extensive private properties help to keep impacts low.

Chambers Island has several wetlands. Large, shallow Mackaysee Lake has some aquatic macrophytes and a few modest ridges and swales on its western shore; it has not been well surveyed. Tiny Mud (or Lost) Lake is surrounded by acidic oak-pine-aspen woodlands with heaths such as huckleberry (*Gaylussacia baccata*), early blueberry (*Vaccinium angustifolium*), and trailing arbutus (*Epi-gaea repens*), and has adjoining wetlands with three-way sedge (*Dulichium arundinaceum*) and sweet flag (*Acorus americanus*). There is also a small leatherleaf (*Chamaedaphne calyculata*)-dominated muskeg about 1 km south of Mackaysee Lake—the only such example of this community in the GTI.

Adventure (Big Strawberry or Strawberry) Island, Wisconsin

This wooded, 8 ha island lies about 5 km northwest of the village of Fish Creek, in Green Bay. Cabins and a dock are located on the south shore. The island was popular in the 1920s and 1930s as a summer camp for boys who built their own "Viking" boats and staged "raids" of the village of Fish Creek as a graduation exercise. Perhaps as a result of intense human activity, the white cedar-basswood-quaking aspen forest of the island is reported to have a dense, shrubby understory dominated by red-osier dogwood (*Cornus stolonifera*), chokecherry, exotic honeysuckle (*Lonicera* sp.), red raspberry, and some Canada yew. There are few herbs and no rare plant species recorded. A Milwaukee Public Museum expedition made several collections here in July 1897.

Little Strawberry Island (North Strawberry Island), Wisconsin (Fig. 56)

In 1998, this small (2.5 ha) island in Green Bay was unique among those surveyed in that the "battle" between invading gulls and cormorants, and native forest trees, was still in doubt. The birds appear to be winning in spite of a determined effort by the owner to frighten them away using wind chimes hung in trees and the thunderous booming of an acetylene cannon that can be heard from Chambers Island to the Door County mainland. The cabin at the east end of the island is swarming with gulls and reminiscent of Bodega Bay, California as envisaged by Alfred Hitchcock in *The Birds*! Little Strawberry Island is forested with a nearly pure stand of basswood on shallow soils derived from dolomite beach cobbles, with cow-parsnip (*Heracleum lanatum*) locally dominant in the understory. In 1998 there were a few remnant mesic forest herbs such as the dicentras (*Dicentra canadensis* and *D. cucullaria*) and yellow trout-lily (*Erythro-*

nium americanum)—herbs which collector J.W. Seaquist noted in 1947 as “blooming profusely all over the island”.

Jack Island, Wisconsin

This small (2 ha), low, brushy island in Green Bay was once forested and the site of a resort as recently as the 1930s, but is now a breeding site for gulls and Double-crested Cormorants. In 1998 only a few dead cottonwoods remained among the red-osier dogwoods and red-berried elders, along with abundant exotic herbs such as motherwort and catnip. Fassett’s 1935 site for plains ragwort (*Senecio congestus*) could not be relocated. Jack Island is connected via sandbar to Little Strawberry Island, and one can wade between the two islands when lake levels are low, as well as to “Pirate Island,” a shoal located a short distance to the northeast of Jack Island, and still appearing on the USGS topographic map

Horseshoe Island (Eagle Island), Wisconsin

A 15 ha island located within and about 1 km north of the mainland portion of Peninsula State Park, Horseshoe Island has some fine stands of white cedar and low dolomite cliffs on its north and west coasts. Younger balsam fir and white birch are also common. Climbing fumitory is locally abundant in the understory, as is the pernicious weed garlic mustard (*Alliaria petiolata*), which is abundant on the adjacent mainland in Peninsula Park.

Sister Islands, Wisconsin

These tiny, low bird islands were not visited in 1998. They lie about 4 km northwest of the village of Sister Bay, on Green Bay. William E. Tans of the WDNR reported box-elder (*Acer negundo*), orange jewelweed (*Impatiens capensis*), red-osier dogwood, bittersweet nightshade (*Solanum dulcamara*), and stinging nettles (*Urtica dioica* subsp. *gracilis*) were common in 1977. In 2000, during extremely low water levels, the islands appeared brushy from the mainland.

Spider Island, Wisconsin

Spider Island lies about 1 km offshore from the south tip of Newport State Park peninsula, on Lake Michigan. It was visited by Milwaukee Public Museum botanists on 1 July 1905. Based on their collections, at that time the island was dominated by white cedar, tamarack, and white birch, with boreal forest and Great Lakes shoreline understory species such as blueflag iris (*Iris virginica*), wood lily (*Lilium philadelphicum*), and Indian paintbrush (*Castilleja coccinea*). It must have been an idyllic spot. By 1966, invasion by waterbirds (Herring and Ring-billed Gulls) had commenced and the forest was recorded as a remnant one dominated by white birch, white cedar, white spruce, and abundant Canada yew, with the shrubs red-osier dogwood, red raspberry, and red-berried elder. Gary Fewless visited and collected plants in 1983 and found an even more degraded flora dominated by exotic herbs, with a few remnant shrubs like yew and wild

black currant. The island was not visited in 1998–1999, but U.S. Fish and Wildlife Service personnel report that the forest is now entirely gone.

Gravel Island, Wisconsin

This 0.7 ha island just off the east side of the tip of the Door Peninsula, is owned by the U.S. Fish and Wildlife Service. It was visited on 22 July 1999, and no vascular plants were seen.

Plum Island, Wisconsin (Figs. 21–22)

This 108 ha island is located in the channel between the tip of the Door Peninsula and Washington Island. It is administered by the U.S. Coast Guard and casual visits are not permitted; there is a U.S. Coast Guard station on the northeast coast, and a lighthouse on the southwest coast (Fig. 21). The interior of this low (maximum elevation, 13 m above Lake Michigan) island is dominated by sugar maple and basswood forests, while white cedar is dominant near the coasts, especially where dolomite is near the surface. William E. Tans (WDNR) visited on 22 July 1974 and reported wonderful old-growth sugar maple and basswood (*Tilia americana*) forests in the interior of this island, with a dense Canada yew understory and no deer (Huntoon 1977). These forests has been significantly impacted by heavy selective logging in the 1980s, and the introduction of deer. The heavy select cut left the canopy open



FIGURE 21. Old lightkeeper's house and range light clearing in southwest coast of Plum Island, Wisconsin. Note deer browse line, 22 July 1999.



FIGURE 22. Calcareous meadow adjacent to "Carp Lake" on northwest side of Plum Island, Wisconsin, during a low water year of Lake Michigan. Brook lobelia (*Lobelia kalmii*) is abundant in this meadow, which is under water in most years, 22 July 1999.

and in 1998–1999 red raspberry and the pernicious weed common hound's-tongue (*Cynoglossum officinale*) are in many places dominant in the understory. Spring ephemerals are absent except near the cross-island trail, where many large trees were retained as a beauty strip. Deer are now abundant and fed by the locals, who also introduced pigs in 1999.

The east and south coast have low, white cedar-clad dolomite bluffs with one-flowered cancer-root (*Orobanche uniflora*) and climbing fumitory fairly frequent in the understory. Sandy, disturbed areas occur near the station, lighthouse, and in range light clearing; in some of these, dune goldenrod (*Solidago simplex* subsp. *randii* var. *gillmanii*) is abundant.

The northwestern part of the island is diverse, but also quite disturbed. There is a 2 ha, very shallow lagoon (over marl and dolomite) called "Carp Lake" by local people, and indeed many of these introduced fish were seen wallowing there during a June 1998 visit. In 1999 water levels in Lake Michigan were much lower and the lagoon was cut off from the lake and surrounded by a meadow (Fig. 22) dominated by brook lobelia (*Lobelia kalmii*), rushes (*Juncus* spp.), and St. John's-worts (*Hypericum* spp.).

Southwest of the lagoon is a 4 ha sedge meadow dominated by bluejoint (*Calamagrostis canadensis*) and tussock sedge (*Carex stricta*), while between the lagoon and coast guard station there is a thin strip of disturbed boreal forest with dwarf lake iris, alvar violet (*Viola nephrophylla*), and white camas (*Zigadenus elegans* subsp. *glaucus*) present.



FIGURE 23. Great Lakes alkaline rockshore on western side of the south tip of Detroit Island, Wisconsin. Baltic rush (*Juncus arcticus* subsp. *littoralis*) and silverweed (*Argentina anserina*) are common here, 16 September 1998.

Detroit Island, Wisconsin (Figs. 23, 48)

Detroit Island is an elongate (6 km long, 0.2–1 km wide) piece of land lying just a few hundred yards east of the Washington Island ferry dock. Occupying 260 ha and rising to a height of 25 m above Lake Michigan, it is underlain by Silurian dolomite that outcrops on the plateau (with many low interior escarpments) north of the isthmus, and near the south tip as low shelves and cobble beaches trailing off into Lake Michigan. Nearly all the island is privately owned; there are about 15 seasonal houses on the east and west coasts north of the isthmus. Deer populations are high and have been so for decades.

The best forests on the north-central high plateau are dominated by sugar maple, white birch, red maple, basswood, red oak, and hop-hornbeam (*Ostrya virginiana*); beech and balsam fir are only occasional in the interior. These forests have been rather heavily selectively cut in the recent past, and shrubs such as red raspberry and chokecherry, as well as common hound's-tongue, are common. On and near the numerous low dolomite scarps, marginal shield fern (*Dryopteris marginalis*) and yellow lady's-slippers (*Cypripedium pubescens*) may be abundant, and there is a picturesque inland six meter high escarpment near the west coast associated with a few supercanopy white pines. Good spring ephemeral displays of dutchman's-breeches (Fig. 48), great-flowered trilliums, wild leeks (*Allium tricoccum*), and Canada and yellow violets (*Viola canadensis* and *V. pubescens*) are present on the central hill. A small black

ash (*Fraxinus nigra*) swamp with tag alder (*Alnus incana* subsp. *rugosa*) and lake sedge (*Carex lacustris*) as codominants is found near the northwest end of the island. White cedar fringes the coast on either side of the central plateau, and in swales just inland from the coast there are several colonies of dwarf lake iris.

The most interesting plant community on Detroit Island is a Great Lakes alkaline rockshore on the west side of the south tip of the island (Fig. 23). Species present here include Baltic rush (*Juncus arcticus* subsp. *littoralis*), silverweed (*Argentina anserina*), bird's-eye primrose (*Primula mistassinica*), low calamint (*Calamintha arkansana*), white camas, indian paint-brush, Seneca snakeroot (*Polygala senega*), several sedges (*Carex aurea*, *C. crawei*, *C. viridula*, and *Rhynchospora capillacea*), marsh fern (*Thelypteris palustris* var. *pubescens*), tufted hairgrass (*Deschampsia cespitosa*), alvar violet (*Viola nephrophylla*), brook lobelia (*Lobelia kalmii*), frost aster (*Aster pilosus* var. *pringlei*), shrubby St. John's-wort (*Hypericum kalmianum*), and lesser fringed gentian (*Gentianopsis procera*). There are also inundated/dead white cedars stands on a small peninsula that juts out to the west from the south tip of the island.

Pilot Island, Wisconsin (Figs. 13, 24, 42)

This small (1 ha) remote island has a lighthouse that was built in 1851 and is now abandoned to the birds and elements. The photographs in Hyde (1987: 150–151) show the station, and the surrounding white cedar and white birch forest, to be in good condition during the 1970s. An unpublished WDNR report



FIGURE 24. Abandoned lighthouse seen through bird-killed forest of white cedar (*Thuja occidentalis*) and white birch (*Betula papyrifera*) on Pilot Island, Wisconsin, 22 July 1999.

(Huntoon 1977) noted that the vegetation was composed of red-osier dogwood, lilacs (*Syringa vulgaris*), Canada yew, "grass", orange jewelweed, sumac, white cedar, willow, birch, and poison-ivy. S. P. Voice visited on 5 June 1982 and found climbing fumitory (*Adlumia fungosa*), growing among dense sweet cicely (*Osmorhiza claytonii*) under a forest of white birch, balsam poplar (*Populus balsamifera*), and quaking aspen near a large gull colony. Subsequent neglect of the structures and the dock, and invasion by breeding cormorants, changed the vegetative composition drastically. The forest was skeletal during a visit on 22 July 1999. The island is now dominated by red-berried elder, red raspberry, chokecherry, motherwort, and catnip.

Washington Island, Wisconsin (Figs. 6, 8, 14, 25–29, 44, 51, 53, 54)

Township-sized Washington Island is by the far the largest island in the Grand Traverse archipelago (occupying 62% of the area of all of the islands), and is the only one that is permanently inhabited. The year-round population of 650 people swells to several thousand during the summer. The island is a checkerboard of operating farms, old fields (Fig. 14), woodlots, and coastal bluffs and wetlands. In all the island is perhaps one-half "open" land with little cultivation and late or irregular haying of fields, thus grassland birds such as Bobolink, Clay-colored Sparrow, and even Upland Sandpiper thrive here.

The GLO survey shows that the interior of the island was dominated in the 1830s by beech and sugar maple forests. Within about 0.5 mile of the coast, es-



FIGURE 25. Dried open marly marsh with partial dolomite cobble pavement in back of barrier beach, Big Marsh, Washington Island, Wisconsin. The dominant plant (on the middle horizon) is softstem bulrush (*Schoenoplectus tabernaemontani*), 17 September 1998.



FIGURE 26. Boreal rich fen at Coffee Swamp, Washington Island, Wisconsin. Visible under the severely browsed white cedars is alder buckthorn (*Rhamnus alnifolius*), tufted bulrush (*Scirpus cespitosus*), and dark-scale cotton-grass (*Eriophorum viridi-carinatum*), 4 June 1998.

pecially the east coast, the forest was coniferous and dominated by hemlock, white cedar, and “spruce” (presumably both white spruce and balsam fir).

The island boasts a flora of 625 species and has been studied by botanists since Charles Goessl of the Milwaukee Public Museum made collections in 1917. The more extensive explorations of Albert B. Fuller (1900–1981) and Herbert Moussa of the same institution in 1926 and 1931 are summarized in a charming account (Fuller 1927) that shows an island somewhat different than today’s. For example butternut (*Juglans cinerea*) was cited as the third most common tree (after beech and sugar maple) in the island’s hardwood forests! Due to logging and disease it is now rare and only one mature tree was seen in 1998, although seedlings and saplings occur near the east coast, Washington Harbor, and in Mountain Tower Park.

From the 1970s through the 1990s, many botanists from the WDNR, University of Wisconsin-Madison, and U.W.-Green Bay made valuable contributions to knowledge of the island’s flora. They concentrated particularly on the Jackson Harbor Ridges preserve in the northeast corner of the island.

Jackson Harbor Ridges is a series of cedar-clad xeric sandy ridges and hydric swales paralleling the harbor, extending eastward to an ephemeral dune pond complex and boreal conifer copses on Carlin Point. The flora is exceedingly diverse and has numerous Wisconsin listed species. It is the richest single site in the archipelago. Dwarf lake iris, bird’s-eye primrose (Fig. 54), and false asphodel literally carpet many acres of ground. Northern comandra (*Geocaulon*

Washington Island



FIGURE 27. Map of Washington Island, Wisconsin.

lividum) is locally frequent under white cedar and balsam fir. One of the most striking finds in recent years was dune willow (*Salix cordata*), by Gary Fewless in 1989. The orchid flora was in the past diverse (Fuller 1927), but deer browsing has apparently eliminated several species; for example, Fuller called the calypso orchid (*Calypso bulbosa*) "locally abundant" here and in other places on the island, but it has not been relocated for decades.

Coffee Swamp is another prominent wetland complex. Located about 1 km inland from the north coast, it can be loosely categorized as a boreal rich fen, with elements of white cedar swamp (Fig. 26). It was probably first visited in 1926 by Fuller (as his "swamp near Andrew Swenson's") and then by Tans in 1974. Cedar copses are mixed with open meadows dominated by giant reed (*Phragmites australis*), calciphilic sedges (*Carex buxbaumii* and *C. livida* var. *radicaulis*), tufted bulrush (*Scirpus cespitosus*; Fig. 44), and false asphodel (*Tofieldia glutinosa*). Shrubby cinquefoil (*Pentaphylloides floribunda*) and alder buckthorn (*Rhamnus alnifolius*) are common in the understory. Diversity is increased by the presence of small mounded acidic sphagnum pockets under some of the cedars that harbor snowberry (*Gaultheria hispidula*), round-leaved sundew (*Drosera rotundifolia*), pitcher plant (*Sarracenia purpurea*) and other acidophiles. At the center of the complex is a small shallow pond with a marl bottom nearly dried up in September 1998, with yellow pond lilies (*Nuphar variegatum*) growing in it (Fig. 8). Rare orchids may once have grown in this swamp but were not evident in 1998. There is a high deer browse line on the white cedars, and the exotic glossy buckthorn (*Rhamnus frangula*) is present and may be spreading. Just north of the fen is a small but fine black ash swamp (Fig. 53) and abandoned cut channel leading north to Lake Michigan (Fig. 28).

There are several other interesting, nutrient-rich wetlands on Washington Island. The north end of Little Lake has a small coastal fen dominated by bogbean, sweet gale, the wire-leaved sedge *Carex lasiocarpa*, the orchids rose pogonia (*Pogonia ophioglossoides*) and grass pink (*Calopogon tuberosus*), and several other calciphiles such as downy willow-herb (*Epilobium strictum*).

Big Marsh is, during most times of the year, an emergent aquatic community with softstem bulrush (*Schoenoplectus tabernaemontani*) and tall bog arrowgrass (*Triglochin maritimum*) dominant in shallow water over marl. By September it may dry up to expose extensive marl flats and a dolomite gravel pavement (Fig. 25); a disjunct from the south, false mermaid-weed (*Proserpinaca palustris* var. *crebra*) occurs in shallow puddles in this habitat. Adjacent boreal fenlike sedge meadows in conifer forest openings to the west of Big Marsh have the rare livid sedge and otherwise resemble Coffee Swamp, but are not quite as rich floristically. These grade into perhaps the best and wettest white cedar swamp in the archipelago, with northern black currant (*Ribes hudsonianum*) and northern bog sedge (*Carex gynocrates*) locally common in the understory. Little Marsh to the north is smaller and more closely ringed by a fringe of black ash swamp.

Attractive Great Lakes alkaline rockshore communities are best developed along about 5 km of the southeast coast (Figs. 29, 51). These shelving dolomitic communities bear an attenuated resemblance to the more extensive alvarlike shorelines of Poverty and Summer Islands to the north. Dwarf lake iris, bird's-eye



FIGURE 28. Artificially blasted outlet (through dolomite) from Coffee Swamp to Lake Michigan on Washington Island, Wisconsin. Common tree is white cedar, and beds of bulblet fern (*Cystopteris bulbifera*) are visible in the distance, 4 June 1998.

primrose, low calamint, and tufted hairgrass are locally common, and other rare species present may include Ohio goldenrod (*Solidago ohioensis*), false asphodel, lesser fringed gentian, and slim-stemmed reed-grass (*Calamagrostis stricta* subsp. *inexpansa*). Most are privately owned small lots with houses well inland, and owners who wish to be good stewards to the rare plants that grow there.

Lake dunes are present at two other places besides Jackson Harbor. At Dunes Park on the south coast (Fig. 6), beach grass is common and the rare species thickspike wheatgrass (*Elytrigia dasystachya* subsp. *psammophilus*), seaside spurge, and a dozen individuals of Pitcher's thistle (*Cirsium pitcheri*) barely survive the intense foot traffic. There is about 0.5 mile of less-impacted private beach and dunes to the east of the park. Another dune system extends north about 1 km north from Percy Johnson County Park on the east coast. Here beach grass and wild rye are common near the beach grading inland into common and spreading juniper thickets among scattered white pines. This is one of the most pleasant spots on the island. The flora includes dwarf lake iris, sandwort (*Arenaria stricta* subsp. *dawsonensis*), dune goldenrod (*Solidago simplex* subsp. *randii* var. *gillmanii*), wood lily (*Lilium philadelphicum*) and abundant lance-leaved coreopsis (*Coreopsis lanceolata* var. *lanceolata*).

High coastal dolomite bluffs on the northeast coast culminate in Boyer's Bluff. These cedar-clad cliffs harbor significant populations of rock whitlow-grass (*Draba arabisans*), and there is also a bulblet fern-covered interior scarp.



FIGURE 29. Great Lakes alkaline rockshore on southeast coast of Washington Island, Wisconsin, 21 July 1999. This shoreline is owned by several private owners who exercise good stewardship of this community.

The finest dolomite escarpment on the island occurs at Mountain Tower Park, where wooden stairs lead one past colonies of green spleenwort (*Asplenium trichomanes-ramosum*) to a wooden lookout tower from which there are spectacular views to the north. The beech-maple woods south of the tower harbors significant populations of the wonderful bluish-waxy broad-leaved sedge *Carex platyphylla* (Fig. 43), which is also found in several other woodlands on Washington Island. Deer populations are high.

Hog Island, Wisconsin

Tiny Hog Island is located about 1 km off the east coast of Washington Island. Low and brushy, it is a breeding site for red-breasted mergansers. Goessl (1916) and Fuller (1926) paid brief visits to this island. Huntoon (1977) records that in the 1970s Canada yew, red-osier dogwood, red-berried elder, red raspberry, and wild black currant formed a dense brush cover, but white cedar, white birch, and aspen were also present, and Canada yew abundant. Hog Island was surveyed on 22 July 1999, and numerous gulls (but no cormorants) were noted. The vegetation is mostly red-berried elder, red raspberry, and other weedy shrubs, but there are a few remnant trees of balsam fir and some Canada yew left.

Rock Island, Wisconsin (Figs. 2, 30, 38, 43, 52)

The highest island in the Grand Traverse archipelago (at 65 m above Lake Michigan), 325 ha Rock Island also has the distinction of being the most remote from the mainland. It is arguably the gem of the chain of islands stretching between the Door and Garden Peninsulas.

The first European inhabitants were fishermen who settled on the southern east coast in the 1840s (Eaton 1979). When fish stocks declined after a few decades, human impacts diminished. In 1910, famed inventor and electrical engineer Hjortur Thordarson (1867–1945) purchased Rock Island and began there a program of building and landscaping that continued for the rest of his life. Thordarson's crowning achievement was the construction of the magnificent "Viking" meeting hall/boathouse near the island's southwest tip. He was reputed to have been an excellent botanist who knew every plant on his island, but I have not been able to find any specimens collected by him. Perhaps there are botanical notes by him in his archive in the Wisconsin State Historical Society. At any rate, Thordarson was also a crotchety figure who often drove uninvited (and, sometimes, invited!) guests away (Eaton 1979). It is noteworthy that the genial Albert Fuller (1927) was able to finagle an invitation to collect on St. Martin Island, but not on the much closer and more interesting Rock Island. So perhaps it is no great surprise that the first known plant collections were not made there until 1969, by Bill Tans. Meanwhile, Rock Island had become a Wisconsin State Park in 1964.

The majority of the interior of Rock Island is covered with impressive older growth southern mesic forest of beech and sugar maple forests on rolling terrain (Figs. 2, 52). GLO survey notes from the 1830s confirm that these species were the dominants at time of white settlement, with small amounts of white cedar, pine, and "spruce" from the southern fringe of the island below the interior

dolomite escarpment. The Fernwood Trail traverses the most impressive areas of this forest. Hop-hornbeam is a frequent understory tree, but hemlocks and other conifers are virtually absent, and only a few yellow birches were noted. The spring ephemeral display features a luxuriant carpet of wild leeks interspersed with Virginia waterleaf (*Hydrophyllum virginianum*) and Carolina spring-beauty and dutchman's-breeches. Due to the long-time presence of deer, almost all seedlings in the forest are beech rather than sugar maple. Broad-leaved wood sedge (Fig. 43; *Carex platyphylla*) is found in scattered small to large colonies in the northern one-third of the island. An unusual "sport" form of the common great-flowered trillium (*Trillium grandiflorum*) with small, green-striped flowers is frequent along the Fernwood Trail.

In the center of the island, along and on the west side of the Fernwood Trail, are hardwoods seeps that have no other counterpart in the archipelago—or perhaps the Door Peninsula, too. A small wet opening in the beech forest is covered with dense growths of ostrich fern (*Matteuccia struthiopteris*) and the state threatened drooping sedge (*Carex prasina*), here found in its only eastern Wisconsin station (Fig. 30). Associates include spring ephemerals such as wild leeks, dutchman's-breeches, and bishop's-cap (*Mitella diphylla*), as well as meadow horsetail (*Equisetum pratense*), hairy-leaved sedge (*Carex hirtifolia*), and black snakeroot (*Sanicula gregaria*).

The interior forest is broken by numerous interior dolomite escarpments, these often with lushly fern-covered boulder and scree slopes. The overstory is white cedar, balsam fir, and sugar maple, often with a dense mountain maple (*Acer spicatum*) understory. Common ferns are bulblet and marginal ferns; less frequent are walking fern (*Asplenium rhizophyllum*), Steller's cliffbrake (*Cryptogramma stelleri*), and spreading woodfern (*Dryopteris expansa*); climbing fumitory also occurs in this habitat. Under beeches and maples on the tops of these escarpments, *Carex platyphylla* occurs, carpeting the ground on one steep slope.

The western, northern and eastern shores of Rock Island have white cedar-clad dolomite cliffs; these are highest at the northwestern tip, below the Potawatomi Lighthouse, built in 1836. The cliff margin cedar forests have a characteristic flora that includes buffaloberry, white camas, ebony sedge (*Carex eburnea*), rough goldenrod (*Solidago hispida*), and abundant rock whitlow-grass, often in mats of the moss *Hylocomium splendens*.

Inland from the southern coast are a series of low, barely perceptible ancient beach ridges with a less nutrient-demanding flora that includes white pines, a white spruce, blueberries (*Vaccinium* spp.) and wintergreen. The beach itself has a remnant Great Lakes dune community dominated by beach grass, Canada wild-rye (*Elymus canadensis*), and beach-pea (*Lathyrus japonicus* var. *maritimus*), mixed with rare species (barely hanging on here) like thickspike wheatgrass, dune goldenrod, and seaside spurge. This dune system has been much-degraded by human impacts during this century. photographs taken in the 1930s and displayed at the Viking Hall show wonderful dunescapes with white cedar seedlings and juniper heaths that do not exist in 1999. In 1964 WDNR naturalist George J. Knudson was still able to record bearberry (*Arctostaphylos uva-ursi*) and wood lily from these dunes—both were gone by 1997. Lake Huron tansy (*Tanacetum huronense*) once occurred on the beach but has not been seen since

Rock Island

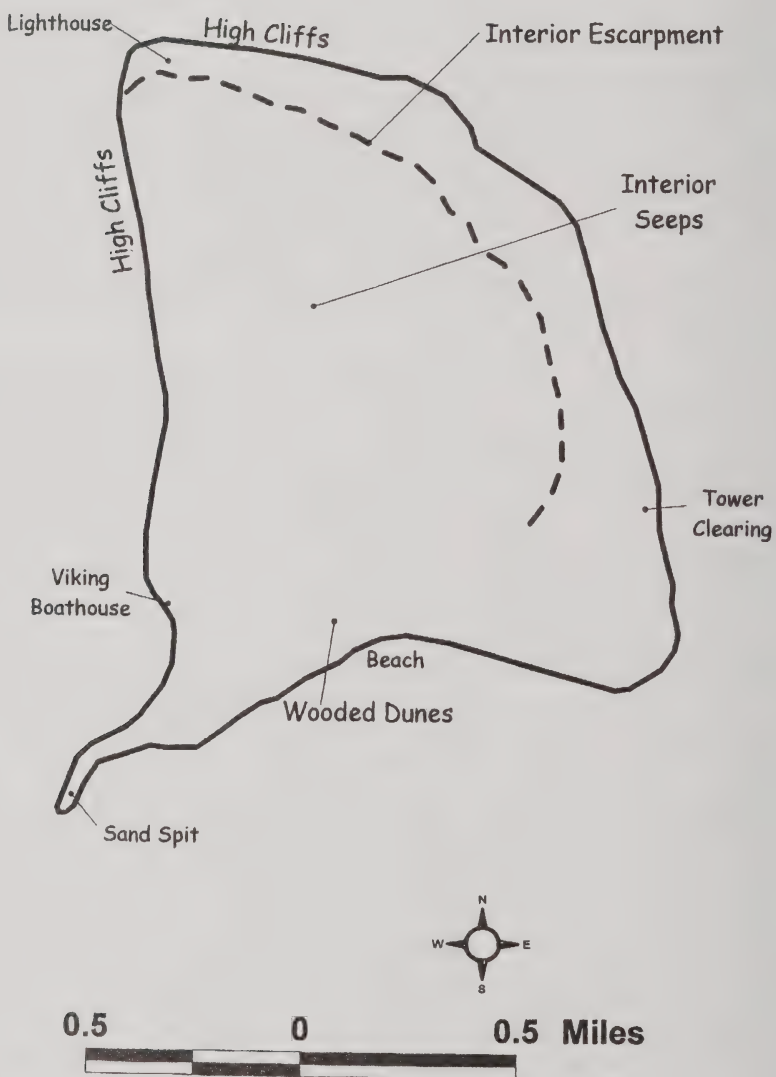


FIGURE 30. Map of Rock Island, Wisconsin.

1972—this was apparently its last station in Wisconsin, and it is presumed extirpated from here and the state.

The only semblance of a wetland on the island is a small abandoned gravel pit about 100 meters east of the Viking Hall. Here dozens of wetland, often calciphilic species occur that are found nowhere else on the island: cattails, soft-stemmed bulrush, brook lobelia, Ohio goldenrod, purple false foxglove (*Agalinis purpurea*), and others.

The flora of 359 species is surprisingly rich considering the near-total lack of wetlands. Exotics, on the other hand, are common in the lawns and clearing that mark the site of the old Thordarson estate. Even casual visitors comment on three striking naturalized exotics that are common here and do no harm: low, creeping or “Icelandic” thyme (*Thymus praecox* subsp. *arcticus*), saxifrage pink (*Petrorhagia saxifraga*), and the strikingly whitened foliage of snow-in-summer (*Cerastium tomentosum*).

Fish Island and Fishermen's Shoal, Wisconsin

These tiny 0.5 ha gravel bars are the farthest eastern points of land in Wisconsin. On 22 July 1999 both were visited, and what appeared from several miles off to be a dark line of vegetation, turned out to be a huge mass of roosting cormorants. Neither islet had any vascular plants.

St. Martin Island, Michigan (Fig. 12)

Except for the lighthouse grounds on the northeast coast, St. Martin Island is nearly all privately owned, and it is the only significant island I was not able to gain permission to visit during this survey. Reportedly there are a few dilapidated cabins in the South and Southwest Bays, and a transinsular road or trail to the lighthouse on the northeast coast, which is pictured by Hyde (1987: 152). The island has a long history of human habitation dating back to the 19th century when a fishing village was established (Fuller 1927, Coppess 1981, Forzley et al. 1993). This village grew to a population of about 100 people, but was abandoned by 1900. Fuller (1927) paid a brief visit on 26 July 1926 and noted that “In the uncut portions of the island are magnificent sugar maples, yellow birches, and white cedars. The floor of the woods are covered with the native yew [*Taxus canadensis*] . . .” Apparently there has been significant logging since that, implying that old-growth hardwoods such as occur on Rock Island do not occur here, because local residents report that the island is now dominated by a third-growth forest of sugar and red maple, beech, white birch, and other tree species. Thad Grudzien, a member of the Cranbrook Institute-Oakland University expeditions of 1989–1990, remembers that there were still places along the transinsular trail where Canada yew was abundant, so there must not have been high populations (or any) white-tailed deer on the island at that time.

White cedar and other conifers are commoner near the coasts, especially on the prominent dolomite bluffs present on the northwest coast and visible from Rock Island (Fig. 12). According to zoologist Grudzien, there is a vernal pond

surrounded by "swamp hardwoods" (perhaps black ash?) about 1 km west of the lighthouse, which shows up as a wooded swamp on the topographic map.

Less than 200 plant species have been documented from the island, most apparently collected in 1989–1990 by the Cranbrook Institute-Oakland University team (1993). Fuller made about 15 collections in 1926, and Eric Bourdo, Jr. a few in 1969.

There are intriguing descriptions of communities and reports of rare plants from St. Martin Island. Fuller (1927) noted that "On the broad stony beach [presumably on the east coast south of the lighthouse, where he landed] the native primrose [*Primula mistassinica*] is abundant . . .," and he also collected climbing fumitory, golden corydalis (*Corydalis aurea*), dwarf lake iris, and small-flowered grass-of-Parnassus (*Parnassia parviflora*) from the island. His "broad stony beach" with primrose and dwarf lake iris, and later collections of Indian paintbrush, white camas, and sight records of smooth aster, suggest that an alvarlike component may be present along the east coast similar to that found on the eastern coasts of Poverty and Summer Islands.

Forzley et al. (1993) report wild chives (*Allium schoenoprasum*). This would be, if verified, the only record of this boreal calciphile from the archipelago; however I could not locate a specimen at BLH or any other herbarium. This species is often cultivated and long-persistent near lighthouses and fishing camps on Isle Royale.

There is also a mysterious record of calypso orchid (*Calypso bulbosa*) from the island, and both small yellow and showy lady's-slippers are known, too. Slender cliffbrake, bulblet fern, smooth cliff brake (*Pellaea glabella*), and hoary whitlow-grass (*Draba cana*) are also reported from the island, surely from the west coast dolomite cliffs; unlike Rock Island, interior escarpments do not appear to be prominent. Finally, Forzley et al. (1993) report several mesic forest herbs which would be disjunct by at least 100 km from their nearest stations to the south, namely woodland phlox (*Phlox divaricata* subsp. *laphamii*) and honewort (*Cryptotaenia canadensis*). Surely St. Martin Island should receive high priority for research in the future.

Gravelly Island, Michigan

Gravelly Island measures only 1.2 ha and was treeless in 1989 (Forzley et al. 1993). The only woody plants recorded were red-berried elder, red-osier dogwood, and wild black currant. Exotics, especially from the mustard family, accounted for many of the two dozen reported species.

Little Gull Island, Michigan

Forzley et al. (1993) recorded the same trees on this 2 ha bird island as on Gull Island; climbing fumitory was also present.

Gull Island, Michigan

This is the largest (5.5 ha) of the trio of small, gravelly bird islands that occur between St. Martin Island and Poverty Island. Forzley et al. (1993) visited them



FIGURE 31. Alvar/Great Lakes alkaline rockshore on east coast of Poverty Island, Michigan, 26 May 1998.

in 1989, but they were not revisited in 1998. Gull Island had the richest flora and apparently the remnants of a forest as indicated by the presence of white cedar, balsam fir, Canada yew, white birch, yellow birch, and quaking aspen.

Poverty Island, Michigan (Figs. 5, 31–32)

This small (78 ha) round island has no dock and is surrounded by dolomite shelves and cliffs. Forzley et al. (1993) reported 173 species based on surveys made in 1989–1990. Mike Penskar and Pat Comer visited and surveyed alvar communities (Fig. 31) on this island in 1995 (Albert *et al.* 1997: Plate 7a), and I was able to add about 30 more species during a reconnaissance on 26 May 1998.

This is a lighthouse island; the tower and keeper's house on the southwest coast were built in 1875 but are now derelict ruins (Fig. 32; Hyde 1987: 152). The island is part of a Michigan State Forest but may be soon transferred to the federal government and administered as part of the Seney Wildlife Refuge. Presently it is used for hunting for, in spite of its tiny size and isolation, a herd of deer lives here! The forest is quite boreal near the transinsular trail, with white spruce and balsam fir common (Fig. 5). Elsewhere there is considerable white birch, quaking aspen, and white cedar; red and sugar maples, beech, and basswood are absent. In the understory, mountain maple and Canada yew are locally abundant. Yew is especially luxuriant in a treacherous "zone of death" near the



FIGURE 32. Abandoned lighthouse on Poverty Island, Michigan, 26 May 1998.

northwest coast that deer are apparently reluctant to venture into—a honey-combed network of narrow, 1–3 meter deep crevices in the dolomite bedrock that extend dozens of meters inland and are concealed by spreading yew branches.

The most interesting natural communities on Poverty Island are the alvar-like Great Lakes alkaline rockshores of the east and south coasts. These narrow (10–25 m wide zones) boast a rich assemblage of calciphiles at the margins of white cedar thickets, including bird's-eye primrose, dwarf lake iris, rare sedges (*Carex richardsonii*, *C. capillaris*, *C. concinna*, *C. crawei*, and *C. garberi*), variegated scouring-rush (*Equisetum variegatum*), marsh fern, blue-eyed grass (*Sisyrinchium montanum*), false asphodel, white camas, frost aster, Ohio goldenrod, shrubby St. John's-wort, low calamint, Seneca snakeroot, silverweed, long-leaved bluets (*Houstonia longifolia*), indian paintbrush, and alvar violet.

Summer Island, Michigan (Figs. 3–4, 9–11, 33–36, 39)

This is the largest of Michigan's Grand Traverse Islands, and has received by far the most botanical attention over the last three decades. The flora of 376 species is fairly completely known. In human terms, Summer Island is a lonesome place, gone to seed; "Autumn Island" would have been a better name. Two or three seasonal homes on Summer Harbor and a hunting shack on the east coast are presently the only dwellings. For many years there was also a boys'

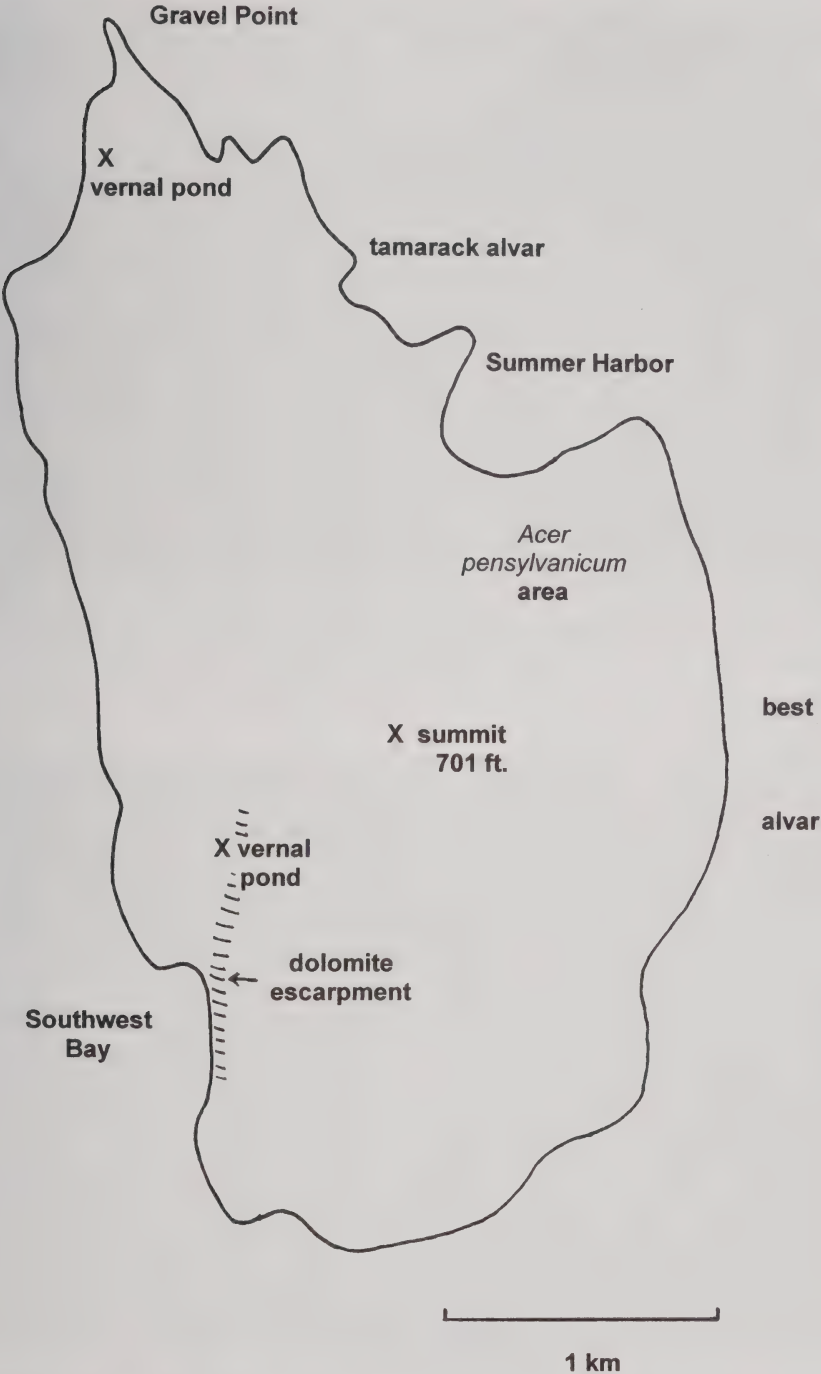


FIGURE 33. Map of Summer Island, Michigan.

summer camp on the harbor, but those buildings are now delapidated. The island suffers from (or enjoys!) the lack of a dock, and is used by local people mostly for deer hunting, with numerous ATV trails leading inland to feeding stations, salt blocks, and blinds on Michigan State Forest land.

The interior of Summer Island is composed of two types of forests. About one-third of the island (including elevations above about 650 feet) is dominated by pole-sized hardwoods. Sugar maple, beech, white and yellow birch, and hop-hornbeam, sometimes with an admixture of hemlock, are the commonest species here (Fig. 3). The groundlayer is poor, and there is essentially no spring ephemeral display anywhere on the island—members of the lily family are present but nowhere common. The forest has been repeatedly selectively cut, fire scars are common, and there is no evidence that farming was ever attempted here. Soils are thin and bedrock appears to be near the surface over most of the island.

The other dominant forest type is a mixed white cedar, balsam fir, red maple, and white birch type found at lower elevations; it, too, has a poor groundlayer. A few rather depauperate seeps (Fig. 4) and vernal ponds are scattered throughout the island, for example in SE¼ of NE¼ of Sec. 33, and near the north tip of the island (Fig. 9), but none has any rare species. Two notable interior species are purple false oats (*Trisetum melicoides*) and striped maple (*Acer pensylvanicum*). The latter species is found over a dozen or so hectares of mixed forest on the southeast side of Summer Harbor. Here it is at its western range limit, and is not found on the Wisconsin islands.

There is a dolomite escarpment that runs roughly north and south through shady white cedar woods along the borders of Sections 33 and 34, along the southwest bay. The fern flora of this scarp is poor, with some slender cliff brake (Fig. 39) and smooth cliff present but no walking fern, spleenworts (*Asplenium* spp.) or dense beds of bulblet or fragile ferns (*Cystopteris* spp.) as are present on the rich seeping interior scarps on Washington and Rock Islands. Climbing fumitory has been collected from Summer Island, but I did not see it there in 1998.

The most significant and interesting plant communities on Summer Island are the coastal alvars and Great Lakes alkaline rockshores (Figs. 10–11, 34–36). These communities are well-developed all along the east coast from the navigation light south to the south tip of the island and occur in a zone from 10–75 m wide along the margins of a white cedar forest. The best alvar community is one designated as “Creeping juniper—shrubby cinquefoil alvar pavement” by Albert *et al.* (1997: Plate 8b) and consisting of a narrow, tree-free “boulevard” or “bowling alley” paralleling the east coast among conifers (Fig. 35). All of the species listed for the Poverty Island alvars occur here, plus a few others such as the lesser fringed gentian and balsam ragwort (*Packera paupercula*). About 1 km northwest of Summer Harbor (in Sec. 22) is a flatter, wetter, alvarlike shoreline with splash pools or puddles, and tamarack co-dominant with white cedar.



FIGURE 34. Great Lakes alkaline rockshore with ninebark (*Physocarpus opulifolius*), tufted hairgrass (*Deschampsia cespitosa*), and low calamint (*Calamintha arkansana*) on east coast of Summer Island, Michigan, 27 May 1998.



FIGURE 35. Alvar on east coast of Summer Island, Michigan, 27 May 1998.



FIGURE 36. Very shallow bay of Lake Michigan (with dolomite gravel and cobbles) on southwest coast of Summer Island, Michigan, 28 May 1998.

Little Summer Island, Michigan (Figs. 37, 40, 49, 50)

This low (12 m above Lake Michigan) 225 ha island was visited of 29 May 1998. I collected or saw 174 plant species, probably about two-thirds of the total flora. Most of the island is a mixed conifer-hardwood forest with white birch, balsam fir, red maple, and white cedar dominant, which is periodically heavily logged. Deer numbers are high. A small area of Michigan State Forest land in the center of the island has a rich sugar maple forest with numerous mesophytes not seen on nearby "Big" Summer Island, namely, Canada and yellow violets, Carolina spring-beauty, wood millet (*Milium effusum*), nodding fescue (*Festuca subverticillata*), Sprengel's sedge (*Carex sprengelii*), and Hitchcock's sedge (*C. hitchcockiana*). The western shore has low dolomite ledges clad with white cedar, a weird cedar cobble glade (Fig. 40), and a new perimeter road along that coast with abundant climbing fumitory springing from banked seeds in disturbed dolomitic gravel. The eastern shoreline has a marly sedge meadow (Figs. 37, 50) dominated by water sedge (*Carex aquatilis*), Baltic rush, and silverweed. Inland from this is a small alvarlike white cedar-fringed margin with Garber's sedge, Indian paintbrush, starry false Solomon's-seal, marsh fern, shrubby St. John's-wort, low calamint, alvar violet, and dwarf lake iris (Fig. 49). Little Summer Island is presently being developed, with new docks at the north and northeast tips, and a large new airstrip. Just to the northwest of Little Summer Island is 3 ha Rocky Island, which was not visited during this survey. It had a low forest of aspen and white birch, many shrubs, and had many visiting waterbirds.



FIGURE 37. Wet calcareous meadow on east coast of Little Summer Island, Michigan, 29 May 1998.

CHECKLIST OF VASCULAR PLANTS OF THE GRAND TRAVERSE ISLANDS

The checklist is arranged in alphabetical order by family, genera, and species under three main headings: Pteridophytes (ferns and fern-allies), Gymnosperms (conifers), and Angiosperms (flowering plants). The nomenclature follows that of the recent checklist of the flora of Wisconsin (Wetter *et al.* 1999). *—indicates that the species is not native to the Grand Traverse Islands. Voucher specimens of nearly all species were collected.

If no collector's name is given and the number range is from 12,480–14,112, then these are my collections and are deposited at either WIS (the vast majority) or MICH (those few that serve as records for Delta County, Michigan). If the number is preceded by a "89-" or "90-" prefix, then these were collected by the Cranbrook Institute-Oakland University Expedition of 1989–1990 and are deposited at BLH. The collectors for that expedition included James Wells, Paul Thompson, Kathleen Forzley, Thaddeus Grudzien, Phyllis Higman, and several other people.

Other main collectors, and the herbaria in which their collections are deposited, are abbreviated as follows: Goessl = Charles Goessl (MIL, WIS and others); Fuller = Albert M. Fuller (MIL); Tans = William E. Tans (MIL, WIS); Tessene = Melvin Tessene (MICH); Ugent = Donald Ugent (WIS); Voss = Edward G. Voss (MICH); Freckmann = Robert W. Freckmann (UWSP); Cochrane = Theodore S. and Barbara A. Cochrane (WIS); Fewless = Gary Fewless (UWGB, University of Wisconsin-Green Bay).

Within each species, the islands are listed from south to north.

The list includes 111 families and 797 species, including 41 pteridophytes, 11 conifers, 228 monocots, and 517 dicots. The largest families are the Cyperaceae (86 species), Asteraceae (76), Poaceae (62), and Rosaceae (43). *Carex* is by far the largest genus, with 62 species. 162 species, or 21% of the flora, are considered as alien exotics.

PTERIDOPHYTES

FERNS

ASPLENIACEAE (Spleenwort Family)

Asplenium rhizophyllum L., walking fern. THREATENED (MI). Walking fern is rare but locally common on large, mossy dolomite boulders on the interior escarpments of Rock Island (12537). It has not been found on the Michigan islands.

A. trichomanes L., maidenhair spleenwort. SPECIAL CONCERN (WI). Small populations were discovered on shaded dolomite bluffs along Old Mill Road on Washington Island (12766). There are no other island reports.

A. trichomanes-ramosum L., green spleenwort. ENDANGERED (WI). A population has long been known, and still exists, on north-facing shaded dolomite cliffs at Mountain Tower Park on Washington Island (Fuller 1605).

DENNSTAEDTIACEAE (Bracken Family)

Pteridium aquilinum (L.) Kuhn var. *latiusculum* (Desv.) A. Heller, bracken fern. Occasional in dry to moist woods, locally common in stabilized dunes. GREEN (13320). CHAMBERS (Ugent 1103). DETROIT (13541). WASHINGTON (Fuller 1381). ROCK (13107). ST. MARTIN (90-331).

DRYOPTERIDACEAE (Wood Fern Family)

Athyrium filix-femina (L.) Mert. var. *angustum* (Willd.) Lawson, lady fern. Common, upland woods. CHAMBERS (Ugent 1099). DETROIT (abundant). PLUM (13346). WASHINGTON (Fuller 1589). ROCK (12495). ST. MARTIN (90-599). POVERTY (89-272). SUMMER (90-688). LITTLE SUMMER (12988).

Cystopteris bulbifera (L.) Bernh., bulblet fern. Fig. 4. Locally common, cool shaded dolomite scree slopes; on Washington Island, forming large beds in areas where old channels had been blasted into dolomite (Coffee Swamp, Big Marsh). DETROIT (13537). WASHINGTON (Fuller 1590). ROCK (Threlfall s.n., UWGB). SUMMER (uncommon, forested seep).

C. laurentiana (Weath.) Blasdel, Laurentian bladder fern. no status (WI), SPECIAL CONCERN (MI). This is a fern of shaded dolomite cliffs. There are collections on St. Martin (89-188) and Summer Islands (90-666) that require verification. It was not seen in 1998.

C. tenuis (Michx.) Desv., MacKay's brittle fern. Moist woods, banks, cliffs, bases of trees. CHAMBERS (12754). PLUM (rare). DETROIT (uncommon). WASHINGTON (Cochrane 11069). ST. MARTIN (89-077). POVERTY (12838). SUMMER (Tessene 53). LITTLE SUMMER (occasional).

Dryopteris carthusiana (Vill.) H.P. Fuchs, spinulose wood fern. Fairly common, woods. GREEN (13225). CANA (occasional). CHAMBERS (13967). DETROIT (13500). WASHINGTON (Fewless & Moore 5955). ROCK (12494). POVERTY (89-288). SUMMER (12905). LITTLE SUMMER (12987).

D. cristata (L.) A. Gray, crested wood fern. Occasional, swamps. CHAMBERS (13966). DETROIT (13867). WASHINGTON (13086). ROCK (13127). SUMMER (12902).

D. expansa (C. Presl) Fraser-Jenkins & Jermy, spreading wood fern. SPECIAL CONCERN (WI). A single specimen was collected in 1997 at the base of a forested dolomite escarpment on Rock Island (12507), and verified by W. Carl Tyalor. This represents the first record for this species from along the shores of Lake Michigan.



FIGURE 38. Unique seep in old-growth beech (*Fagus grandifolia*) forest in interior of Rock Island, Wisconsin. The seep is dominated by ostrich fern (*Matteuccia struthiopteris*) and drooping sedge (*Carex prasina*). Other common species are wild leeks (*Allium tricoccum*), dutchman's-breeches (*Dicentra cucullaria*), and nettles (*Urtica dioica* subsp. *gracilis*), 15 May 1999.

D. intermedia (Willd.) A. Gray, intermediate wood fern. Common, woods. GREEN (13217). CHAMBERS (13952). PLUM (13328). WASHINGTON (Fuller 1492). ROCK (13834). ST. MARTIN (90-512). LITTLE GULL (90-614). GULL (89-182). POVERTY (89-278). SUMMER (90-667). LITTLE SUMMER (Freckmann 13144).

D. marginalis (L.) A. Gray, marginal wood fern. Locally dominant on cool, shaded dolomite scree slopes as on the interior escarpments on Rock Island. PLUM (12692). DETROIT (12657). WASHINGTON (Fuller 1600). ROCK (12501).

Gymnocarpium dryopteris (L.) Newman, common oak fern. Occasional, moist woods and cliffs. CANA (occasional). CHAMBERS (12749). PLUM (uncommon). DETROIT (13549). WASHINGTON (Fuller 1479). ROCK (13896). POVERTY (12837). SUMMER (12867). LITTLE SUMMER (12986).

Matteuccia struthiopteris (L.) Todaro, ostrich fern. Fig. 38. Occasional to locally common in swamps. CHAMBERS (13943). PLUM (13423). DETROIT (13526). WASHINGTON (Threlfall s.n., UWGB). ROCK (13815). SUMMER (12888, Freckmann 13171).

Onoclea sensibilis L., sensitive fern. Occasional, wet places. CHAMBERS (Ugent 1104). PLUM (13419). DETROIT (13545). WASHINGTON (Fuller 1563). ROCK (13122). LITTLE GULL (Cranbrook Institute-Oakland University sight record). POVERTY (90-254). SUMMER (90-630). LITTLE SUMMER (12987.5).

OPHIOGLOSSACEAE (Grape-Fern Family)

Botrychium multifidum (S.G. Gmel.) Rupr., leathery grape-fern. Rare, woods or clearings. SUMMER (Tessene 34).

B. virginianum (L.) Sw., rattlesnake fern. Common, woods. CHAMBERS (12706). PLUM (13421). DETROIT (13525). WASHINGTON (Fuller 1423). ROCK (12612). ST. MAR-

TIN (*Cranbrook Institute-Oakland University sight record*). POVERTY (occasional). SUMMER (*Freckmann 13170*). LITTLE SUMMER (occasional).

OSMUNDACEAE (Flowering-Fern Family)

Osmunda cinnamomea L., cinnamon fern. Uncommon, moist to wet woods. CHAMBERS (13968). DETROIT (13479). WASHINGTON (*James H. Zimmerman sight record, 3 Oct. 1998*). SUMMER (*Freckmann sight record, 1976*).

O. claytoniana L., interrupted fern. Not seen in present survey. WASHINGTON (listed for the island in James Peck's notecard file at MIL).

O. regalis L. var. *spectabilis* (Willd.) A. Gray, royal fern. Uncommon, swamps and dolomite shoreline pools. DETROIT (13465). WASHINGTON (*Fuller 1549*). SUMMER (12903).

POLYPODIACEAE (Polypody Family)

Polypodium virginianum L., common polypody. Occasional to fairly common, dolomite cliffs. DETROIT (13589). WASHINGTON (*Schutz 176, UWGB*). ROCK (12639). ST. MARTIN (90-500). POVERTY (12834). SUMMER (*Voss 12614*).

PTERIDACEAE (Maidenhair Fern Family)

Adiantum pedatum L., maidenhair fern. Occasional, rich moist woods. CHAMBERS (*Ugent 1102*). DETROIT (13847). WASHINGTON (*Fuller 1459*). ROCK (13170). ST. MARTIN (90-318). SUMMER (*Voss 12653*). LITTLE SUMMER (12949).

Cryptogramma stelleri (S.G. Gmel.) Prantl, slender cliff brake. Fig. 39. No status (WI), SPECIAL CONCERN (MI). In 1998, this fern of shaded dolomite cliffs was rare on Washington (Mountain Tower Park, *Fuller 1604*, MIL) and Rock (interior escarpment near the lighthouse; 12518) Islands in Wisconsin, and on escarpments on St. Martin (90-687) and Summer (12870) Islands, Michigan.

Pellaea glabella Mett. ex Kuhn, smooth cliff brake. Rare, dolomite cliffs. ST. MARTIN (Sec. 16; 90-503). SUMMER (*Voss 12647*).



FIGURE 39. Slender cliff brake (*Cryptogramma stelleri*) on shaded dolomite escarpment along southwest bay of Summer Island, Michigan, 27 May 1998.

THELYPTERIDACEAE (March Fern Family)

Thelypteris palustris Schott var. *pubescens* (Lawson) Fernald, marsh fern. Locally common in swamps, fens, and shoreline dolomite crevices and rock pools. CHAMBERS (*Ugent 1105*). DETROIT (*13462*). WASHINGTON (*Fuller 1448*). ROCK (*13107*). POVERTY (*90-270*). SUMMER (*12876*). LITTLE SUMMER (*12934*).

FERN ALLIES

EQUISETACEAE (Horsetail Family)

Equisetum arvense L., field horsetail. Common, moist disturbed areas and shores. CHAMBERS (*Ugent 1106*). PLUM (rare). DETROIT (*13460*). WASHINGTON (*Fewless & Moore 5942*). ROCK (*13132*). POVERTY (*12807*). SUMMER (*Tessene 38*). LITTLE SUMMER (fairly common).

E. fluviatile L., river horsetail. Rare, in a black ash swamp on DETROIT (*13475*) and on a beach on SUMMER (*Freckmann 13156*).

E. hyemale L. subsp. *affine* (Engelm.) Calder & Roy L. Taylor, common scouring rush. Occasional to fairly common, wet areas. CHAMBERS (*Ugent 1107*). DETROIT (*12784*). WASHINGTON (*Fewless 5946*). ROCK (*13195*). ST. MARTIN (*89-129*). LITTLE SUMMER (*12928*).

E. palustre L., marsh horsetail. SPECIAL CONCERN (WI). There is an old record from an interior swamp (Little Marsh) on Washington Island (*Goessl 3983*). The species was not seen in the GTA in 1998.

E. pratense Ehrh., meadow horsetail. Rare, known only from a hardwood seep in the interior of Rock Island (*12497*).

E. scirpoides Michx., dwarf scouring rush. Occasional, moist, often coniferous woods. CHAMBERS (*Ugent 1109*). DETROIT (*13602*). WASHINGTON (*Goessl 3953*). POVERTY (*12829*). SUMMER (*12854*).

E. variegatum F. Weber & D. Mohr, variegated scouring rush. No status (MI); SPECIAL CONCERN (WI). This species is scattered but never common on Great Lakes alkaline rockshore/alvar/wet sand. It is found on Chambers Island (Sand Point swale, *13728*), Plum Island (Carp Lake, *14067*), Detroit Island (south end, *13572*; north bay, *Alverson 1257* [WIS] in 1979), Washington Island (Jackson Harbor Ridges, also on a roadside near Big Marsh, *Fuller 1567*), Rock Island (borrow pit, *12612*), and on alvars on Poverty (*89-192*) and Summer (*Freckmann 13158*) Islands, Michigan.

E. X ferrissii Clute, Ferriss' horsetail. Rare. WASHINGTON (*Fuller 1399*).

LYCOPODIACEAE (Clubmoss Family)

Diphasiastrum complanatum (L.) Holub, northern running-pine. Uncommon. WASHINGTON (*Fuller 1485*).

D. digitatum (A. Braun) Holub, southern running-pine. Occasional, especially in cedar-fir thickets near the coast. WASHINGTON (*Schutz 106*, UWGB). POVERTY (*12805*). SUMMER (*90-775*).

Huperzia lucidula (Michx.) Trevis, shining clubmoss. Occasional, woods. CHAMBERS (rare, *12736*). WASHINGTON (*Goessl 3919*). ROCK (*12636*). ST. MARTIN (*90-587*). GULL (*89-177*). POVERTY (*90-269*). SUMMER (*Hagenah et al. 6715*, MSC).

Lycopodium annotinum L., bristly clubmoss. Uncommon, woods. WASHINGTON (*Fuller 1486*). POVERTY (*89-270*). SUMMER (*90-660*).

L. clavatum L., running clubmoss. Occasional, often under cedars near cliff edges. CHAMBERS (*12746*). WASHINGTON (*Fewless 5512*). ROCK (*12638*). POVERTY (*12827*). SUMMER (*12911*). LITTLE SUMMER (*12983*).

L. dendroideum Michx., northern tree clubmoss. Uncommon, upland woods. WASHINGTON (*Fuller 1484*). ST. MARTIN (*90-553*). SUMMER (*Tessene 50*, *Freckmann 13108*).

SELAGINELLACEAE (Spikemoss Family)

Selaginella eclipses W.R. Buck, northern meadow spikemoss. Occasional, moist crevices in shoreline dolomites. PLUM (*14068*). DETROIT (*13568*). WASHINGTON (*Fewless 5214*). POVERTY (*89-201*). SUMMER (*90-624*).



FIGURE 40. Strange cobble glade community (trees are deer-browsed white cedar, *Thuja occidentalis*) on west coast of Little Summer Island, Michigan, 29 May 1998. The understory shrub is buffaloberry (*Shepherdia canadensis*). A similar community occurs along the north coast of Washington Island, Wisconsin northwest of Coffee Swamp.

GYMNOSPERMS

CUPRESSACEAE (Cypress family)

Juniperus communis L. var. *depressa* Pursh, common juniper. Figs. 7, 14. Common, coastal dunes; inland mostly in old fields. CHAMBERS (*Ugent 1096*). LITTLE STRAWBERRY (uncommon). PLUM (13295). DETROIT (13501). WASHINGTON (*Fuller 1391*). ROCK (*Cochrane 5206*). ST. MARTIN (89-116). SUMMER (*Tessene 18*). LITTLE SUMMER (uncommon).

J. horizontalis Moench, creeping juniper. Occasional, restricted to coastal dunes. CHAMBERS (12727). WASHINGTON (*Fuller 1515*). ST. MARTIN (89-112). POVERTY (89-290). SUMMER (*Voss 12624*).

Thuja occidentalis L., northern white cedar. Figs. 12, 28, 40. Common tree; dominant on cliff edges; declining on small islands. SNAKE (fairly common). GREEN (13211). CANA (abundant). CHAMBERS (rare, *Ugent 1095*). ADVENTURE (abundant). LITTLE STRAWBERRY (rare). HORSESHOE (abundant). SPIDER (collected in 1905, MIL; extirpated). PLUM (13357). DETROIT (13891). PILOT (rare in 1999, one 3 m tall tree seen). WASHINGTON (*Fuller 1398*). ROCK (13099). LITTLE GULL (*Cranbrook Institute-Oakland University sight record*). GULL (89-183). POVERTY (common). SUMMER (*Freckmann 13117*). LITTLE SUMMER (abundant).

PINACEAE (Pine Family)

Abies balsamea (L.) Mill., balsam fir. Fig. 11. Fairly common, coastal woods. GREEN (13242). CANA (abundant). ADVENTURE (occasional). HORSESHOE (fairly common). PLUM (14055). DETROIT (occasional). WASHINGTON (*Fuller 1507*). HOG (uncommon). ST. MARTIN (89-071). LITTLE GULL (*Cranbrook Institute-Oakland University*

- sight record). GULL (*Cranbrook Institute-Oakland University sight record*). POVERTY (90-272). SUMMER (*Tessene 14*). LITTLE SUMMER (abundant).
- Larix laricina* (Du Roi) K. Koch, tamarack. Occasional, swamps and coastal dolomite rock pool margins. SPIDER (1905 collection, MIL; now extirpated). WASHINGTON (*Fuller 1466*). SUMMER (*Tessene 14*). LITTLE SUMMER (uncommon).
- Picea glauca* (Moench) Voss, white spruce. Occasional near coasts. GREEN (rare). CANA (occasional). SPIDER (recorded in 1966). WASHINGTON (*Fuller 1513*). ROCK (12642). POVERTY (89-079). SUMMER (*Tessene 16*). LITTLE SUMMER (occasional).
- P. mariana* (Mill.) Britton, Sterns & Poggenb., black spruce. Uncommon, mostly interior swamps and bogs. WASHINGTON (Jackson Harbor Ridges, *Fewless 6936*).
- Pinus resinosa* Aiton, red pine. Uncommon, dune forests. CHAMBERS (*Ugent 1093*). WASHINGTON (*Fuller 1396*). SUMMER (rare, only one seen in 1998; 12912).
- P. strobus* L., white pine. Fig. 7. Occasional in forests; locally common on forested dunes and barrens. GREEN (rare). CHAMBERS (fairly common, *Ugent 1098*). PLUM (rare coastal tree). DETROIT (large trees near west coast interior bluffs). WASHINGTON (*Fuller 1561a*). ROCK (13664). ST. MARTIN (90-330). SUMMER (90-685).
- Tsuga canadensis* (L.) Carrière, eastern hemlock. Fig. 20. Occasional in the interiors of the larger islands. CHAMBERS (fairly common; *Ugent 1094*). PLUM (uncommon). DETROIT (uncommon on interior cliffs). WASHINGTON (occasional; *Fuller 1397*). ROCK (rare; 12633). SUMMER (uncommon; *Tessene 58*).

TAXACEAE (Yew Family)

- Taxus canadensis* Marshall, Canada yew. "TRACKED" (WI). Dense colonies occur only on Green (13239) and Adventure Islands in Wisconsin, and on Poverty (locally abundant in 1998) and St. Martin (89-037; Thaddeus Grudzien, pers. comm.) Islands, Michigan. Fuller (1927) reported it as very abundant on the latter island in 1926. Other large islands have remnant populations, mostly on dolomite cliffs that deer cannot reach. CHAMBERS (rare, 12704). PLUM (abundant in 1974; absent in 1999). DETROIT (rare, 12788). SPIDER (*Fewless 3167*). WASHINGTON (*Fuller 1438*). ROCK (rare, 12519). LITTLE GULL (*Cranbrook Institute-Oakland University sight record*). GULL (*Cranbrook Institute-Oakland University sight record*). SUMMER (*Tessene 56*).

ANGIOSPERMS

ACORACEAE (Sweet-Flag Family)

- Acorus americanus* (Raf.) Raf., sweet flag. Rare, known only from a marsh on Mud Lake, Chambers Island (13931).

ACERACEAE (Maple Family)

- Acer negundo* L., box-elder. Occasional, shores. SNAKE (fairly common). GREEN (13209). CHAMBERS (13770). LITTLE STRAWBERRY (rare). SISTER (common in 1977). PLUM (13404).
- A. nigrum* F. Michx., black maple. Rare, Jackson Harbor on Washington Island (*Fewless 5178*).
- A. pensylvanicum* L., striped maple, moosewood. No status yet in Wisconsin; none in Michigan. This small tree is common in a mixed conifer-hardwood forest understory on north-eastern Summer Island, Michigan (*Voss 13400*), under sugar maple, white birch, white cedar, and balsam fir, and with juneberry, hop-hornbeam, and mountain maple. It was recently (1997) found on the Door County mainland in Newport State Park by Mike Grimm, the first record for Wisconsin.
- **A. platanoides* L., Norway maple. Only from a shoreline on Green Island (13206).
- A. rubrum* L., red maple. Common. GREEN (13220). CHAMBERS (*Ugent 1211*). DETROIT (uncommon). WASHINGTON (*Fewless 5180*). ROCK (13657). ST. MARTIN (89-138). SUMMER (*Voss 13394*).
- A. saccharinum* L., silver maple. Rare; only a sight record (1998) from a shoreline on Chambers Island.



FIGURE 41. Second-growth forest of sugar maple (*Acer saccharum*) in the interior of Chambers Island, Wisconsin. The understories of the forests of this island are poor in herbs, because of either poor soils or the effects of past high deer densities, 9 May 1998.

- A. saccharum* Marshall, sugar maple. Figs. 2, 41. Common. CHAMBERS (*Ugent 1216*). PLUM (13345). DETROIT (common). WASHINGTON (*Fuller 1374*). ROCK (13125). ST. MARTIN (89-069). SUMMER (*Voss 13393*). LITTLE SUMMER (abundant).
- A. spicatum* Lam., mountain maple. Common, especially in shade of dolomite bluffs. CANA (common). HORSESHOE (uncommon). PLUM (13312). DETROIT (13459). WASHINGTON (*Fuller 1505*). ROCK (13675). ST. MARTIN (89-062). LITTLE GULL (*Cranbrook Institute-Oakland University sight record*). GULL (*Cranbrook Institute-Oakland University sight record*). POVERTY (90-215). SUMMER (*Tessene 55*). LITTLE SUMMER (occasional).

ALISMATACEAE (Water-Plantain Family)

- Alisma triviale* Pursh, northern water-plantain. Rare, marshes. CHAMBERS (13748). *Sagittaria latifolia* Willd., broad-leaved arrowhead. Rare, marshes. SNAKE (fairly common). WASHINGTON (*Schutz 42, UWGB*).

AMARANTHACEAE (Amaranth Family)

- Amaranthus albus* L., tumbleweed. Rare weed of old fields. ROCK (12486). *Amaranthus hypochondriacus* L., prince's-feather. Rare escape from cultivation. WASHINGTON (*Schuette s.n.*, 13 Sept. 1989, WIS). *A. powellii* S. Watson, Powell's amaranth. Uncommon shoreline weed. HOG (uncommon). DETROIT (13889). PILOT (uncommon). WASHINGTON (13838).

ANACARDIACEAE (Cashew or Sumac Family)

- **Rhus aromatica* Aiton, fragrant sumac. Long persisting and spreading at site of old fishing village on east coast of Rock Island (12627). *R. hirta* (L.) Sudw., staghorn sumac. Occasional weedy species of fields and bird islands. SNAKE (uncommon). GREEN (common, 13270). CANA (rare). ADVENTURE (occa-

sional). CHAMBERS (*Ugent 1209*). DETROIT (*13441*). WASHINGTON (*Fuller 1430*). ST. MARTIN (*89-010*).

Toxicodendron rydbergii (Rydb.) Greene., western poison-ivy. Common on dunes, sandy and gravelly old fields and pastures. SNAKE (rare). GREEN (abundant, *13256*). CHAMBERS (*Ugent 1208*). PLUM (fairly common). DETROIT (fairly common). WASHINGTON (*Fuller 1429*). ROCK (common on sand spit). ST. MARTIN (*Cranbrook Institute-Oakland University sight record*). POVERTY (occasional). SUMMER (uncommon).

APIACEAE (Carrot Family)

**Carum carvi* L., caraway. Rare weed in 1926. WASHINGTON (*Fuller 1496*).

Cicuta bulbifera L., bulblet water-hemlock. Occasional, swamps and alkaline shores. CHAMBERS (*13969*). PLUM (*14064*). DETROIT (rare). WASHINGTON (*Schutz 116*, UWGB). SUMMER (*12853*).

C. maculata L., common water-hemlock. Rare, wetlands. WASHINGTON (*Fewless & Moore 5912*).

Cryptotaenia canadensis (L.) DC., honewort. Rare, presumably from rich upland woods. ST. MARTIN (*89-043*).

**Daucus carota* L., Queen Anne's-lace, wild carrot. Common weed. DETROIT (*13945*). PLUM (*14047*). DETROIT (*13884*). WASHINGTON (*Fewless 5533*). POVERTY (*Cranbrook Institute-Oakland University sight record*). SUMMER (*Freckmann 13224*).

Heracleum lanatum Michx., cow-parsnip. Fig. 56. Common meadow and woods edge species; locally common on gull islands. SNAKE (rare). GREEN (*13214*). HAT (rare). CHAMBERS (locally common in woods near Retreat House). ADVENTURE (occasional). LITTLE STRAWBERRY (*Seaquist s.n.*, 21 July 1947, WIS; common in 1998). JACK (occasional). HORSESHOE (uncommon). SPIDER (1905 collection, MIL). PLUM (rare). DETROIT (*13536*). PILOT (occasional). WASHINGTON (uncommon). ROCK (*Cochrane 5231*). ST. MARTIN (*89-076*). SUMMER (only at north tip, *12851*). LITTLE SUMMER (*12982a*).

Osmorhiza berteroi DC., Chilean sweet-cicely. SPECIAL CONCERN (WI) as *Osmorhiza chilensis*. Rare, collected once in a white cedar forest on Rock Island in 1972 (*Cochrane 5222*), and not relocated in 1998. There are several recent collections from the Door Peninsula.

O. claytonii (Michx.) C.B. Clarke, hairy sweet-cicely. Common, woods. SNAKE (uncommon). GREEN (*13236*). CHAMBERS (*13980*). HORSESHOE (occasional). PLUM (*13417*). DETROIT (*13486*). PILOT (S.P. Voice sight record in 1982, recorded as "dense"). WASHINGTON (*Fuller 1460*). ROCK (*13157*). ST. MARTIN (*89-061*). SUMMER (*90-724*). LITTLE SUMMER (*12957*).

O. longistylis (Torr.) DC., smooth sweet-cicely. Occasional, woods. PLUM (*13348*). DETROIT (rare). WASHINGTON (*Goessl 3930*). ROCK (*13155*). SUMMER (*Freckmann 13141*).

**Pastinaca sativa* L., wild parsnip. Uncommon weed. ST. MARTIN (*89-046*). POVERTY (*Cranbrook Institute-Oakland University sight record*). SUMMER (*90-719*). LITTLE SUMMER (*12992*).

Sanicula gregaria E.P. Bicknell, clustered black snakeroot. Occasional, rich woods. HORSESHOE (rare). WASHINGTON (*Fuller 1592*). ROCK (*12499*).

S. marilandica L., black snakeroot. Uncommon, woods. DETROIT (*13524*).

Sium suave Walter, water-parsnip. Occasional, marshes, swamps, and shoreline pools. CHAMBERS (*13970*). DETROIT (uncommon, black ash swamp). WASHINGTON (*Schuetz s.n.*, 12 Sept. 1889, WIS). ST. MARTIN (*90-310*). SUMMER (*90-759*).

Taenidia integerrima (L.) Drude, yellow-pimpernel. Rare, known only from "bluffs of Lake Michigan" on Chambers Island in 1961 (*Ugent 1199*). Not noted in 1998.

Zizia aurea (L.) W.D.J. Koch, golden alexanders. Rare, known only from Washington Island in 1916 (*Goessl 3987*). Not noted in 1998-1999.

APOCYNACEAE (Dogbane Family)

Apocynum androsaemifolium L., spreading dogbane. Common, old fields. SNAKE (rare). CHAMBERS (*Ugent 1206*). PLUM (*13339*). DETROIT (*13502*). WASHINGTON (*Fuller*

1574). ROCK (*Threlfall s.n.*, UWGB). POVERTY (12801). SUMMER (*Tessene 46*). LITTLE SUMMER (12996).

A. cannabinum L., Indian-hemp. Occasional, mostly on lake beaches. GREEN (13193). WASHINGTON (*Threlfall s.n.*, UWGB).

A. sibiricum Jacq., clasping dogbane. Rare, known only from Chambers Island in 1961 (*Ugent 1178*).

Vinca minor L. periwinkle. Rare escape. SNAKE (rare).

AQUIFOLIACEAE (Holly Family)

Ilex verticillata (L.) A. Gray, winterberry holly. Uncommon, swamps. DETROIT (13469).

WASHINGTON (Coffee Swamp black ash swamp, *Fuller 1544*; 13071).

Nemopanthes mucronatus (L.) Loes., mountain holly. Known only from a sight record made by James H. Zimmerman in Coffee Swamp, Washington Island, on 3 October 1988.

ARACEAE (Arum Family)

Arisaema triphyllum (L.) Schott, jack-in-the-pulpit. Occasional, rich woods. GREEN (13223). CHAMBERS (*Ugent 1075*). ADVENTURE (uncommon). PLUM (12684). DETROIT (fairly common). WASHINGTON (*Fuller 1524*). ROCK (12626). SUMMER (*Voss 12644*). LITTLE SUMMER (12952).

ARALIACEAE (Ginseng Family)

Aralia nudicaulis L., wild sarsaparilla. Common to abundant in woods. SNAKE (uncommon). GREEN (13197). PLUM (13310). DETROIT (fairly common). WASHINGTON (*Fuller 1376*). ROCK (*Cochrane 5200*). ST. MARTIN (89-058). POVERTY (fairly common). SUMMER (*Voss 13402*). LITTLE SUMMER (occasional).

A. racemosa L., spikenard. Occasional in rich woods. CHAMBERS (13742). PLUM (13420). DETROIT (13498). WASHINGTON (*Fuller 1562*). ROCK (13119). ST. MARTIN (90-314). SUMMER (*Tessene 116*).

ASCLEPIADACEAE (Milkweed Family)

Asclepias incarnata L., swamp milkweed. Uncommon, open wetlands. CHAMBERS (*Ugent 1176*). WASHINGTON (*Schutz 129*, UWGB). SUMMER (*Tessene 33*).

A. syriaca L., common milkweed. Fairly common, dunes and old fields. SNAKE SNAKE (occasional). CHAMBERS (*Ugent 1177*). PLUM (13280). DETROIT (fairly common, north field). WASHINGTON (fairly common). ROCK (13646). ST. MARTIN (90-573). SUMMER (*Tessene s.n.*). LITTLE SUMMER (uncommon).

A. tuberosa L. subsp. *interior* Woodson, butterfly-weed. Rare, known only from small populations in Great Lakes pine barrens on Sand Point and on the north bay of Chambers Island (13760).

ASTERACEAE (Aster Family)

Achillea millefolium L., yarrow. Common in a variety of disturbed and shoreline habitats. SNAKE (fairly common). GREEN (13258). CANA (fairly common). CHAMBERS (*Ugent 1126*). PLUM (13289). DETROIT (fairly common). WASHINGTON (*Fuller 1358*). HOG (occasional). ROCK (13100). ST. MARTIN (*Cranbrook Institute-Oakland University sight record*). GRAVELLY (*Cranbrook Institute-Oakland University sight record*). POVERTY (occasional). SUMMER (*Freckmann 13250*). LITTLE SUMMER (occasional).

**A. ptamica* L., sneezeweed. Rare escape on Washington Island (*Threlfall s.n.* UWGB).

Ambrosia artemisiifolia L., common ragweed. Occasional weedy species. SNAKE (occasional). HAT (occasional). CHAMBERS (*Ugent 1149*). WASHINGTON (13781). SUMMER (*Freckmann sight record*, 1976).

A. psilostachya DC. western ragweed. Uncommon on dunes and barrens. CHAMBERS (*Ugent 1147*). DETROIT (13895). WASHINGTON (*Fuller 1616*). ST. MARTIN (89-028).

Anaphalis margaritacea (L.) Benth. & Hook. f., pearly everlasting. Fairly common, old fields. CHAMBERS (*Ugent 1145*). PLUM (14045). DETROIT (uncommon, north field). WASHINGTON (*Fuller 1468*). ROCK (*Tans 811*). POVERTY (*Cranbrook Institute-Oak-*

- land University sight record). SUMMER (Long s.n., 27 July 1974, UWSP). LITTLE SUMMER (occasional).
- Antennaria howellii* Greene subsp. *neodioica* (Greene) R.J. Bayer, field pussy-toes. Common, old fields and dunes. CHAMBERS (12722). PLUM (12678). DETROIT (occasional). WASHINGTON (Cochrane 11103). ROCK (13151). POVERTY (12812). SUMMER (12885). LITTLE SUMMER (12944).
- **Arctium minus* Bernh., common burdock. Occasional weed near buildings; locally common on bird islands. SNAKE (uncommon). GREEN (uncommon). HAT (occasional). CHAMBERS (Ugent 1122). LITTLE STRAWBERRY (uncommon). JACK (common). PLUM (uncommon). DETROIT (fairly common). WASHINGTON (Rose 306, UWGB). ROCK (13686). ST. MARTIN (Cranbrook Institute-Oakland University sight record). GRAVELLY (Cranbrook Institute-Oakland University sight record). POVERTY (Cranbrook Institute-Oakland University sight record). SUMMER (Cranbrook Institute-Oakland University sight record). LITTLE SUMMER (occasional).
- **Artemisia absinthium* L., absinthe wormwood. Rare weed in open sandy places in 1926 on Washington Island (Fuller 1357); also from that island in 1889 by Schuette (WIS).
- **A. biennis* Willd., biennial wormwood. Rare weed. WASHINGTON (Fewless & Moore 5936). HOG (rare, 14035).
- A. campestris* L. subsp. *caudata* (Michx.) H.M. Hall & Clem., beach wormwood. Locally common on Great Lakes sand dunes. CHAMBERS (Ugent 1146). WASHINGTON (Fewless & Moore 5939). SUMMER (Freckmann sight record, 1976).
- Aster ciliolatus* Lindl., Lindley's aster. Occasional; commonest in calcareous cedar-fir thickets near the coast. CANA (uncommon). CHAMBERS (Ugent 1166). PLUM (14048). DETROIT (uncommon, south tip). WASHINGTON (13798). ROCK (13827). ST. MARTIN (90-566). POVERTY (12804). SUMMER (Freckmann 13252).
- A. ericoides* L., heath aster. Rare, only in Great Lakes pine barrens on north bay of Chambers Island (13988).
- A. laevis* L., smooth aster. Locally common, sandy areas on Chambers Island (Ugent 1162); Jackson Harbor Ridges on Washington Island (Fewless & Moore 5956); reported from St. Martin Island (Cranbrook Institute-Oakland University sight record).
- A. lanceolatus* Willd., panicle aster. Frequent, swamps and shorelines. SNAKE (occasional). CANA (rare). CHAMBERS (13962). DETROIT (13876). WASHINGTON (Fewless & Moore 5938). SUMMER (Freckmann 13128). LITTLE SUMMER (rare).
- A. lateriflorus* (L.) Britton, calico aster. Frequent, fields and woods edges. CHAMBERS (13921). DETROIT (13868). WASHINGTON (13790). ROCK (rare). SUMMER (Freckmann 13256).
- A. macrophyllus* L., big-leaved aster. Common, woods. SNAKE (uncommon). CHAMBERS (Ugent 1164). PLUM (uncommon). DETROIT (common). WASHINGTON (Fuller 1377). ROCK (13813). ST. MARTIN (90-530). POVERTY (12839). SUMMER (Tessene 80). LITTLE SUMMER (Freckmann 13143).
- A. novae-angliae* L., New England aster. Rare near east coast and in interior, Washington Island, perhaps an escape from cultivation (13787, 13791).
- A. pilosus* Willd. var. *pringlei* (A. Gray) S.F. Blake, Pringle's frost aster. Common and characteristic of dolomitic Lake Michigan shorelines. PLUM (14041). DETROIT (13856). PILOT (14037). WASHINGTON (Fuller 1408). ROCK (13812.5, borrow pit). POVERTY (common). SUMMER (Freckmann 13254).
- A. puniceus* L., purple-stemmed aster. Uncommon, swamps and marshes. CHAMBERS (Ugent 1167). WASHINGTON (13787). POVERTY (89-209). SUMMER (Tessene 82).
- A. sagittifolius* Willd., arrow-leaved aster. Uncommon, fields and woods. WASHINGTON (Threlfall s.n., UWGB). ROCK (12509).
- A. umbellatus* Mill., flat-topped aster. Uncommon, wetlands. WASHINGTON (13803).
- **Bellis perennis* L., English daisy. Locally common in a lawn near the south shore of Washington Island (12765).
- Bidens cernuus* L., nodding beggar-ticks. Occasional, wetlands. CANA (uncommon). CHAMBERS (13918). PLUM (14042). DETROIT (13853). WASHINGTON (Fewless & Moore 5925). HOG (rare).

- B. connatus* Willd., purple-stemmed beggar-ticks. Rare, wetlands, Washington Island (Fewless & Moore 5937).
- B. frondosus* L., common beggar-ticks. Only from wetlands on Snake Island (rare) and Chambers Island (Ugent 1144, 13908).
- **Centaurea biebersteinii* DC., spotted knapweed. Common weed of dunes and dry gravel. SNAKE (uncommon). GREEN (13199). CHAMBERS (13924). PLUM (14053). DETROIT (locally common near dock). WASHINGTON (Fewless 5554). ROCK (13650). SUMMER (Freckmann 13257).
- **C. montana* L., mountain-bluet. Rare weed, Washington Island (13037).
- **Cichorium intybus* L., chicory. Uncommon weed. PLUM (13429). DETROIT (rare). WASHINGTON (Fuller 1597).
- **Cirsium arvense* (L.) Scop., Canada thistle. Common weed. SNAKE (occasional). CHAMBERS (Ugent 1135). PLUM (14050). DETROIT (uncommon). WASHINGTON (Fuller 1365). ROCK (13674). POVERTY (Cranbrook Institute-Oakland University sight record). SUMMER (Freckmann 13151). LITTLE SUMMER (occasional).
- **C. palustre* (L.) Scop., European swamp thistle. Occasional weed, mostly on Lake Michigan shorelines. SNAKE (rare). PLUM (13390). DETROIT (13519). WASHINGTON (Fuller 1405). ROCK (13656). POVERTY (89-283). SUMMER (Voss 13368). LITTLE SUMMER (rare).
- C. pitcheri* (Eaton) Torr. & A. Gray, dune or Pitcher's thistle. Fig. 6. THREATENED (WI and MI). FEDERALLY LISTED. A Great Lakes dune species that has been adversely affected by development and vehicular and foot traffic, it was seen in the GTI in 1998-1999 only at Dunes Park on Washington Island, where known since 1916 (Goessl 3993, MIL). There only a few plants remain, but more might be found on less disturbed, privately-owned dunes to the east.
- **C. vulgare* (Savi) Ten., bull thistle. Occasional weed. SNAKE (occasional). CHAMBERS (Ugent 1264). ADVENTURE (uncommon). LITTLE STRAWBERRY (uncommon). HORSESHOE (uncommon). PLUM (14061). DETROIT (uncommon). PILOT (occasional). WASHINGTON (Fuller 1580). GRAVELLY (Cranbrook Institute-Oakland University sight record). LITTLE GULL (Cranbrook Institute-Oakland University sight record). POVERTY (12800). SUMMER (Freckmann 13258). LITTLE SUMMER (uncommon).
- Conyza canadensis* (L.) Cronquist, horseweed. Occasional weedy species of disturbed areas, especially pastures. SNAKE (occasional). CHAMBERS (Ugent 1141). PLUM (14057). DETROIT (13841). WASHINGTON (Fewless & Moore 5931). ROCK (12545). Q (13260).
- Coreopsis lanceolata* var. *lanceolata*, lance-leaf tickseed. Local, found only on coniferous-forested dunes on Washington Island at Jackson Harbor (Fuller 1520) and Percy Johnson County Park.
- **Crepis tectorum* L., hawk's-beard. Rare shoreline weed on Plum Island (13430).
- Erechtites hieracifolia* (L.) DC., burnweed. Uncommon weedy species. CHAMBERS (1123). WASHINGTON (13795). ROCK (12547).
- Erigeron annuus* (L.) Pers., annual fleabane. Occasional weedy species. SNAKE (occasional). CHAMBERS (Ugent 1143). DETROIT (13594). WASHINGTON (13626). ST. MARTIN (90-583).
- E. philadelphicus* L., marsh fleabane. Frequent species of fields and woods edges. CHAMBERS (Ugent 1140). ADVENTURE (occasional). PLUM (13316). DETROIT (13590). WASHINGTON (13012). ROCK (13120). ST. MARTIN (Cranbrook Institute-Oakland University sight record). POVERTY (90-214). SUMMER (90-649). LITTLE SUMMER (12939).
- E. strigosus* Willd., daisy fleabane. Fairly common species of weedy, often dry habitats. SNAKE (occasional). CHAMBERS (Ugent 1139). PLUM (13292). DETROIT (13491). WASHINGTON (Threlfall s.n., UWGB). ST. MARTIN (Cranbrook Institute-Oakland University sight record). SUMMER (Tessene 10).
- Eupatorium maculatum* L., Joe-Pye-weed. Uncommon, wetlands. SNAKE (occasional). WASHINGTON (Fewless 5528). LITTLE SUMMER (rare).

- E. perfoliatum* L., boneset. Occasional, wetlands and alkaline rockshores. SNAKE (occasional). CHAMBERS (13981). PLUM (14059). DETROIT (13859). WASHINGTON (Fewless 5560). SUMMER (Tessene 94).
- E. rugosum* Houtt., white snakeroot. Uncommon, upland woods. SNAKE (occasional). DETROIT (13849). WASHINGTON (13783).
- Euthamia graminifolia* (L.) Nutt., grass-leaved goldenrod. Occasional, wetlands and alkaline rockshores. CHAMBERS (13919). PLUM (14083). DETROIT (uncommon, dock). WASHINGTON (Fuller 1582). POVERTY (12833). SUMMER (Freckmann 13268).
- Gnaphalium obtusifolium* L., rabbit-tobacco. Uncommon, dry open areas. CHAMBERS (13927). DETROIT (13875). SUMMER (Freckmann 13262).
- Helianthus* sp., sunflower. Rare, dry areas. WASHINGTON (Rose 311, UWGB).
- Helianthus helianthoides* (L.) Sweet ox-eye. Restricted to Great Lakes pine barrens on Chambers Island (13942).
- **Hieracium aurantiacum* L., orange hawkweed. Common weed, often abundant in lawns, fields, and dunes. GREEN (13248). CANA (common). CHAMBERS (Ugent 1268). PLUM (13334). DETROIT (13515). WASHINGTON (Rose 402, UWGB). ROCK (Cochrane 5181). ST. MARTIN (Cranbrook Institute-Oakland University sight record). POVERTY (occasional). SUMMER (fairly common). LITTLE SUMMER (12943).
- **H. caespitosum* Dumort., yellow king-devil. Occasional weed. CHAMBERS (Ugent 1137). WASHINGTON (Fewless 5211). SUMMER (Freckmann 13264).
- H. kalmii* L., Canada hawkweed. Occasional, often in cedar-fir thickets near coasts. CHAMBERS (13774). PLUM (13318). DETROIT (rare, south tip). WASHINGTON (Fewless 5522). ROCK (13823). SUMMER (12894).
- **H. piloselloides* Vill., glaucous king-devil. Common weed. SNAKE (uncommon). GREEN (13255). CANA (uncommon). CHAMBERS (Ugent 1136). HORSESHOE (occasional). PLUM (13314). DETROIT (13599). WASHINGTON (Schutz 22, UWGB). ROCK (Cochrane 5180). ST. MARTIN (Cranbrook Institute-Oakland University sight record). POVERTY (90-260a). SUMMER (12855). LITTLE SUMMER (12999).
- Lactuca canadensis* L., Canada lettuce. Occasional, fields and woods. GREEN (rare). CANA (uncommon). CHAMBERS (Ugent 1267). PLUM (14080). DETROIT (uncommon). WASHINGTON (Fewless & Moore 5940). ROCK (uncommon). SUMMER (Freckmann 13173).
- **Leucanthemum vulgare* Lam., ox-eye daisy. Common weed. CANA (occasional). CHAMBERS (uncommon). ADVENTURE (uncommon). LITTLE STRAWBERRY (rare). PLUM (13333). DETROIT (13527). WASHINGTON (Fuller 1401). ROCK (Cochrane 5179). ST. MARTIN (Cranbrook Institute-Oakland University sight record). POVERTY (90-232). SUMMER (Tessene 39). LITTLE SUMMER (fairly common).
- Liatris aspera* Michx., rough blazing-star. Only on Great Lakes pine barrens on Chambers Island (13904).
- **Matricaria discoidea* DC., pineapple-weed. Occasional weed. SNAKE (uncommon). GREEN (13189). HOG (uncommon). WASHINGTON (12529).
- Packera aurea* (L.) A. Löve & D. Löve, golden ragwort. Rare, known only from a "small opening" on Summer Island (Freckmann 13107).
- P. paupercula* (Michx.) A. Löve & D. Löve, balsam ragwort. Uncommon, alkaline rockshores. WASHINGTON (Fuller, 1926 sight record). POVERTY (12824). SUMMER (Freckmann 13267).
- Petasites frigidus* (L.) Fr. var. *palmatus* (Aiton) Cronquist, northern sweet colt's-foot. Uncommon in cool, often coniferous woods. ROCK (13088). SUMMER (90-709). LITTLE SUMMER (rare).
- Prenanthes alba* L., rattlesnake-root. Occasional, shores, edges, and woods. CHAMBERS (Ugent 1124). HORSESHOE (uncommon). DETROIT (rare). WASHINGTON (Fuller sight record, 1926). ROCK (13814).
- Rudbeckia hirta* L. var. *pulcherrima* Farw., black-eyed susan. Common, fields and shores. SNAKE (uncommon). CHAMBERS (Ugent 1132). ADVENTURE (Bruncken s.n., 16 July 1897, MIL). PLUM (13332). DETROIT (occasional). WASHINGTON (Rose 277, UWGB). ROCK (13643). ST. MARTIN (89-036). POVERTY (90-202a). SUMMER (Tessene 29). LITTLE SUMMER (occasional).

- Senecio congestus* (R. Br.) DC., marsh ragwort. SPECIAL CONCERN (WI), EXTIRPATED (MI). There is a 15 June 1935 collection by Norman C. Fassett (*s.n.*, WIS) from Jack Island in Green Bay; this site was searched unsuccessfully on 8 June 1998. Marsh ragwort may be extirpated in both Wisconsin and Michigan (Judziewicz & Nekola 1999).
- **S. vulgaris* L., common groundsel. Occasional on bird islands. SNAKE (occasional). LITTLE STRAWBERRY (occasional). JACK (uncommon).
- Solidago canadensis* L., Canada goldenrod. Common, fields and shores. GREEN (occasional). CANA (common). CHAMBERS (*Ugent 1155*). PLUM (*14044*). DETROIT (*13870*). PILOT (uncommon). WASHINGTON (*Fewless & Moore 5949*). ROCK (*13832*). ST. MARTIN (*89-083*). SUMMER (*Freckmann 13269*).
- S. flexicaulis* L., zigzag goldenrod. Locally common, rich woods. SNAKE (fairly common). CHAMBERS (*13944*). HORSESHOE (occasional). PLUM (rare). DETROIT (fairly common). WASHINGTON (*Fuller 1379*). ROCK (*13816*). ST. MARTIN (*89-083*). SUMMER (rare, *12907*). LITTLE SUMMER (*12945*).
- S. gigantea* Aiton, late goldenrod. Rare, only from Summer Island (*Freckmann 13271*).
- S. hispida* Willd., hairy goldenrod. Locally common on dry to moist dolomite cliffs, often under white cedar. CHAMBERS (*Ugent 1158*). HORSESHOE (uncommon). PLUM (occasional). DETROIT (*Alverson 1254*, WIS). WASHINGTON (*Schuette s.n.*, 14 Sept. 1889, WIS; *Fewless & Moore 5910*). ROCK (*13819*). ST. MARTIN (*90-322*). POVERTY (occasional). SUMMER (*Freckmann 13270*). LITTLE SUMMER (occasional).
- S. juncea* Aiton, early goldenrod. Occasional, sandy or gravelly old fields, and cedar-fir thickets near the coast. WASHINGTON (*13697*). POVERTY (*89-287*). SUMMER (*Tessene 151*).
- S. nemoralis* Aiton, gray goldenrod. Uncommon, dry old fields. WASHINGTON (*Threlfall s.n.*, UWGB). ROCK (*12534*).
- S. ohioensis* Riddell, Ohio goldenrod. SPECIAL CONCERN (WI). This is another characteristic species of Great Lakes alkaline rockshore, alvar, and forested ridge and swale communities. It is locally common on Washington Island (*Fuller 1575*; southeast coast and Jackson Harbor Ridges), rare on Rock Island (*12553*), and common on the east coasts of Poverty (*89-220*) and Summer (*Bourdo s.n.*, 11 Aug. 1969, MSC) Islands, Michigan. Its close relative, the regional endemic *Solidago houghtonii* A. Gray (Houghton's goldenrod), was searched for unsuccessfully in the GTA in 1998; its closest station is near Thompson, Michigan, just northeast of the Garden Peninsula.
- S. simplex* Kunth subsp. *randii* (Porter) G.S. Ringius var. *gillmanii* (A. Gray) G.S. Ringius, dune goldenrod. THREATENED (WI), as *Solidago simplex* var. *gillmanii*. Another Great Lakes alkaline rockshore/alvar/lake dune species, populations are known from Detroit (rare, west coast, *13845*), Washington ("dry hills, Little Lake", *Schuette s.n.*, 30 July 1887, WIS) southeast coast and Jackson Harbor Ridges; *Wadmond s.n.*, 7 Sept. 1934, MIL), Plum (locally common on the Light Station grounds, *14088*) and Rock (south beach, *12484*) Islands, and from the eastern coasts of Little Gull (*Cranbrook Institute-Oakland University sight record*), Poverty (*89-256*), and Summer (*Tessene 81*) Islands, Michigan.
- S. uliginosa* Nutt., bog goldenrod. Rare, known only from Coffee Swamp on Washington Island (*Moussa s.n.*, 25 Aug. 1928, MIL).
- **Sonchus arvensis* L., perennial sow-thistle. Common weed or roadsides and shores. SNAKE (occasional). CHAMBERS (*Ugent 1154*). CANA (occasional). DETROIT (*13883*). ROCK (*13822*). SUMMER (*Freckmann 13124*).
- **S. oleraceus* L., common sow-thistle. Uncommon weed. WASHINGTON (*Schutz 118*, UWGB).
- Tanacetum huronense* Nutt., Lake Huron tansy. ENDANGERED (WI), THREATENED (MI). This regional lake dune endemic appears to be declining because of increased development and vehicular and foot traffic. The Rock Island (south beach) station was last noted in 1971 (*Threlfall s.n.*, UWGB) and 1972 (*Cochrane 5203*, WIS) as locally common in sand with *Elymus canadensis*. It was not relocated in 1979 (by W.S. Alverson) or in 1997-1999. There was also a site on the Summer Harbor dunes on Summer Island, Michigan; collections were made in 1968 by Tessene (*s.n.*), and on 24 Aug. 1976 by Freckmann (*13274*). This site was not relocated in 1998 and is presumed extirpated in Wisconsin and on the GTI.
- **T. vulgare* L., common tansy. Occasional weed. PLUM (*14051*). WASHINGTON (*Fuller 1434*). ROCK (*13818*). ST. MARTIN (*90-542*).

**Taraxacum officinale* Weber, common dandelion. Common to abundant weed. SNAKE (fairly common). GREEN (13204). CANA (common). CHAMBERS (*Ugent* 1128). ADVENTURE (uncommon). HORSESHOE (uncommon). PLUM (uncommon). DETROIT (occasional). WASHINGTON (*Goessl* 3934). ROCK (12620). POVERTY (uncommon). SUMMER (*Tessene* 68). LITTLE SUMMER (occasional).

**Tragopogon dubius* Scop., goat's-beard. Fairly common weed. GREEN (13266). CHAMBERS (*Ugent* 1125). PLUM (13402). DETROIT (13490). WASHINGTON (occasional). ROCK (13639). ST. MARTIN (*Cranbrook Institute-Oakland University sight record*). POVERTY (*Cranbrook Institute-Oakland University sight record*). SUMMER (*Freckmann* 13275).

**Xanthium strumarium* L., cocklebur. Locally common, sandy beaches (such as Sand Point) on Chambers Island (13907).

BALSAMINACEAE (Jewelweed Family)

Impatiens capensis Meerb., orange jewelweed or touch-me-not. Common, wetlands. SNAKE (abundant). CHAMBERS (*Ugent* 1218). ADVENTURE (uncommon). LITTLE STRAWBERRY (uncommon). SISTER (common, 1977). PLUM (14043). DETROIT (fairly common). W (*Rose* 287, UWGB). ROCK (13833). POVERTY (*Cranbrook Institute-Oakland University sight record*). SUMMER (*Tessene* 120). LITTLE SUMMER (fairly common).

BERBERIDACEAE (Barberry Family)

**Berberis thunbergii* DC., Japanese barberry. Occasional escape from cultivation. CHAMBERS (13985). HORSESHOE (rare). PLUM (13410). DETROIT (13539). WASHINGTON (13185).

Caulophyllum thalictroides (L.) Michx., blue cohosh. Rich upland woods; absent from the Michigan islands. SNAKE (uncommon). PLUM (13355). DETROIT (13528). W (12648). ROCK (*Cochrane* 5230).

Podophyllum peltatum L., May-apple. Rare, one clone known from rich woods in the center of Chambers Island (12716).

BETULACEAE (Birch Family)

Alnus incana (L.) Moench subsp. *rugosa* (Du Roi) R.T. Clausen, speckled alder. Fairly common, wetlands; apparently rare or absent on the Michigan islands. CHAMBERS (*Ugent* 1050). PLUM (rare). DETROIT (13457). WASHINGTON (*Fuller* 1467).

Betula alleghaniensis Britton, yellow birch. Locally common upland tree on the larger islands. CHAMBERS (uncommon, 13961). DETROIT (uncommon). WASHINGTON (*Goessl* 3961). ROCK (rare, only a few trees on the Fernwood Trail). ST. MARTIN (apparently once common as large trees, *Fuller* 1632). GULL (*Cranbrook Institute-Oakland University sight record*). SUMMER (12873).

B. papyrifera Marshall, white or paper birch. Common to abundant tree. SNAKE (occasional). GREEN (13213). CANA (occasional). CHAMBERS (*Ugent* 1053). ADVENTURE (fairly common). LITTLE STRAWBERRY (rare). HORSESHOE (fairly common). SPIDER (present in 1966). PLUM (13294). PILOT (once common, but all trees dead in 1999). DETROIT (13446). WASHINGTON (*Fuller* 1375). HOG (all dead in 1999). ROCK (13131). LITTLE GULL (*Cranbrook Institute-Oakland University sight record*). GULL (89-171). POVERTY (occasional). SUMMER (*Voss* 13399). LITTLE SUMMER (abundant).

Corylus cornuta Marshall, beaked hazelnut. Fairly common understory shrub. GREEN (13259). DETROIT (13458). WASHINGTON (*Fuller* 1380). ROCK (13158). ST. MARTIN (90-524). SUMMER (*Voss* 13395). LITTLE SUMMER (fairly common).

Ostrya virginiana (Mill.) K. Koch, eastern hop-hornbeam. Fairly common tree of rich upland woods. CHAMBERS (*Ugent* 1051). PLUM (13342). DETROIT (common). WASHINGTON (*Fuller* 1553). ROCK (13153). ST. MARTIN (89-120). SUMMER (*Freckmann* 13284). LITTLE SUMMER (occasional).

BORAGINACEAE (Borage Family)

Cynoglossum boreale Fernald, northern wild comfrey. Uncommon in cool coniferous woods. WASHINGTON (*Fuller* 1679). ROCK (13177).

- **C. officinale* L., common hound's-tongue. An abundant weed on dolomite cliffs, heavily logged woods, scree slopes, and bird islands. SNAKE (fairly common). CHAMBERS (*Ugent 1183*). CANA (uncommon). HORSESHOE (occasional). PLUM (*13304*). DETROIT (*13529*). WASHINGTON (*Fuller 1364*). ROCK (*13154*). POVERTY (*90-233*). SUMMER (*Tessene 86*). LITTLE SUMMER (abundant).
- **Echium vulgare* L., viper's-bugloss. Locally common on roadsides in the interior of Washington Island (*Rose 304*, UWGB).
- Hackelia deflexa* (Wahlenb.) Opiz var. *americana* (A. Gray) Fernald & I.M. Johnst., American stickseed. Occasional, dryish woods, perhaps increasing because of dispersal of the seeds by deer. CHAMBERS (*13951*). WASHINGTON (*Fuller 1529*). ROCK (*Cochrane 5182*). SUMMER (*Voss 13368a*).
- Lithospermum carolinense* (J.F. Gmel.) MacMill. subsp. *croceum* (Fernald) Cusick, hairy puccoon. Rare, only in Great Lakes pine barrens on Chambers Island (*13761*).
- **L. officinale* L., European gromwell. Occasional weed. ROCK (*12481*). POVERTY (*89-231*). SUMMER (*Tessene 27*). LITTLE SUMMER (occasional).
- **Myosotis arvensis* (L.) Hill., field forget-me-not. Rare, known only from Boyer Bluff, Washington Island (*Cochrane 11054*).
- **M. scorpioides* L., common forget-me-not. Occasional weed of wet areas. HORSESHOE (rare). PLUM (*13353*). DETROIT (uncommon). WASHINGTON (*Rose 400*, UWGB). LITTLE SUMMER (*12965*).

BRASSICACEAE (Mustard Family)

- **Alliaria petiolata* (M. Bieb.) Cavara & Grande, garlic-mustard. A pernicious weed of rich upland woods. Locally established on Washington Island (*Cochrane 11083*) and Rock Island (*12515*). Active measures are ongoing to control it on the latter island. Abundant on Horseshoe Island in 1998, and on the adjacent mainland in Peninsula State Park.
- Arabis divaricarpa* A. Nelson, spreading-pod rock-cress. Occasional, shores and dunes. SNAKE (fairly common). GREEN (*13252*). CHAMBERS (*Ugent 1039*). PLUM (*13321*). DETROIT (*13578*). WASHINGTON (*Fuller 1567*). ROCK (*Cochrane 5188*). ST. MARTIN (*89-026*). LITTLE GULL (*90-611*). POVERTY (*Cranbrook Institute-Oakland University sight record*). SUMMER (*Freckmann 13279*).
- A. glabra* (L.) Bernh., tower mustard. Occasional, shores. ADVENTURE (uncommon). DETROIT (*13578*). WASHINGTON (*Fuller 1432*). ROCK (*13665*). GULL (*89-169*). SUMMER (*Bourdo 20059*, MSC).
- A. hirsuta* (L.) Scop., hairy rock-cress. Occasional but characteristic of alkaline rockshores and cliffs. CHAMBERS (*Ugent 1032*). PLUM (*13374*). DETROIT (*12773*). ROCK (*12522*). ST. MARTIN (*89-102*). POVERTY (*90-260b*). SUMMER (*Tessene 21*). LITTLE SUMMER (*12962*).
- A. lyrata* L., sand cress. Locally common on dunes and in barrens. CHAMBERS (*12726*). PLUM (*12679*). DETROIT (*12772*). WASHINGTON (*Fuller 1425*). ROCK (*12629*). ST. MARTIN (*89-115*). POVERTY (*89-297*). SUMMER (*Voss 12611*).
- **Armoracia rusticana* P. Gaertn., B. Mey. & Scherb., horseradish. Rare persisting escape in a ditch on Washington Island (*14007*).
- Barbarea orthoceras* Ledeb., winter-cress. Uncommon. POVERTY (*89-271*). SUMMER (*90-728*).
- **Barbarea vulgaris* R. Br., winter-cress. Fairly common weed. CANA (occasional). ADVENTURE (uncommon). LITTLE STRAWBERRY (uncommon). JACK (common). PLUM (rare). DETROIT (uncommon). WASHINGTON (*Goessl 3977*). ROCK (*13142*). GRAVELLY (*Taylor s.n.*, MSC). SUMMER (*90-699*).
- **Berteroa incana* (L.) DC., hoary-alyssum. Occasional weed. SNAKE (occasional). CHAMBERS (*13937*). PLUM (*13425*). DETROIT (*13444*). WASHINGTON (*Schutz 98*, UWGB). HOG (uncommon). ROCK (*13648*). GRAVELLY (*89-149*).
- Cakile edentula* (Bigelow) Hook., American sea-rocket. SPECIAL CONCERN (WI). First recorded on Chambers Island in 1961 (*Ugent 1033*), in 1998 large populations were found on lake beaches there at Sand Point and on the south tip of the island. On Washington Island it is known from the Michigan Road beaches, Dunes Park (*Cochrane 11087*), and from Jackson Harbor.

- **Capsella bursa-pastoris* (L.) Medik., shepherd's-purse. Common weed, including on bird islands. SNAKE (uncommon). HAT (rare). CHAMBERS (*Ugent 1040*). JACK (rare). SISTER (*Seaquist 101, 102, WIS*). PLUM (*13283*). DETROIT (*12793*). HOG (uncommon). WASHINGTON (*12770*). ROCK (*12528*). GRAVELLY (*Cranbrook Institute-Oakland University sight record*). LITTLE GULL (*Cranbrook Institute-Oakland University sight record*). GULL (*89-148*). LITTLE SUMMER (*12976*).
- Cardamine concatenata* (Michx.) O. Schwarz., cut-leaved toothwort. Occasional in rich woods. WASHINGTON (*12054*). ROCK (*12622*). LITTLE SUMMER (*12948*).
- C. diphylla* (Michx.) A.W. Wood, broad-leaved toothwort. Locally common in rich woods. PLUM (*12681*). DETROIT (uncommon, rich woods near cliffs). ROCK (*12621*).
- C. pennsylvanica* Willd., bitter-cress. Uncommon, wet areas. DETROIT (*12776*). SUMMER (*Tessene 152*).
- C. pratensis* L. var. *palustris* Wimm. & Grab., cuckoo-flower. SPECIAL CONCERN (WI). There is a 1917 record from "wet open places" on Washington Island (*Goessl 3969, WIS*), where it was recorded as "rare". It has not been relocated since in the GTA.
- **Descurainia pinnata* (Walter) Britton subsp. *brachycarpa* (Richardson) Detling, green tansy mustard. Occasional weed. GREEN (*13190*). ADVENTURE (*Bruncken s.n.*, 11 July 1905, MIL). LITTLE STRAWBERRY (*Seaquist s.n.*, 21 June 1947, WIS). DETROIT (*12795*). WASHINGTON (*Fuller 1599*). ROCK (*13687*). ST. MARTIN (*89-009*). GRAVELLY (*89-146*). LITTLE GULL (*Cranbrook Institute-Oakland University sight record*). POVERTY (*89-295*).
- Draba arabisans* Michx., rock whitlow-grass. SPECIAL CONCERN (WI), THREATENED (MI). Locally abundant in white cedar forests on coastal cliffs on Washington Island (Boyer Bluff and for several miles to the south; *Fuller 1591*) and Rock Island (along all but the south coast; *Tans 815*); rare on Detroit Island (*12782*). Not known from the Michigan Islands.
- D. cana* Rydb., hoary whitlow-grass. ENDANGERED (WI), THREATENED (MI). There are recent records (1989–1990) from dolomite bluffs on the west coast of St. Martin Island, Michigan (*89-103, 90-502*).
- **Draba verna* L., spring whitlow-grass. Rare; only along gravelly trails on Rock Island (*12598*).
- **Erucastrum gallicum* (Willd.) O.E. Schulz, dog-mustard. Rare weed. SNAKE (uncommon). SPIDER (*Fewless 3168, UWGB*). WASHINGTON (*13634, WIS*).
- **Erysimum cheiranthoides* L., wormseed mustard. Frequent weed, especially on bird islands. SNAKE (uncommon). CHAMBERS (*Ugent 1034*). LITTLE STRAWBERRY (*Seaquist s.n.*, 21 June 1947, WIS). PLUM (*14038*). WASHINGTON (*Schutz 94, UWGB*). HOG (occasional). ST. MARTIN (*90-570*). GRAVELLY (*89-153*). LITTLE GULL (*90-602*). GULL (*89-180*). POVERTY (*12803*).
- **Hesperis matronalis* L., dame's-rocket. Uncommon weed. CANA (common). PLUM (*13341*). LITTLE SUMMER (*12963*).
- **Lepidium campestre* (L.) R. Br., fieldcress. Uncommon weed. CANA (uncommon). DETROIT (*12794*). WASHINGTON (*Fewless 5167*).
- L. densiflorum* Schrad., pepper-weed. Fairly common weed. CHAMBERS (*Ugent 1041*). DETROIT (*13843*). WASHINGTON (*Fuller 1568*). ROCK (*13658*). SUMMER (*Freckmann 13276*).
- L. virginicum* L. Virginia pepper-weed. Rare weed. SUMMER (*Long s.n.*, 27 July 1974, UWSP).
- Rorippa palustris* (L.) Besser, yellow-cress. Occasional, wetlands and alkaline rockshores. SNAKE (fairly common). CANA (rare). PLUM (*14070*). DETROIT (*13575*). WASHINGTON (*Fewless 5526*). GRAVELLY (*Taylor s.n.*, 24 July 1978, MSC). SUMMER (*12877*).
- **Sinapis arvensis* L., charlock mustard. Rare weed. WASHINGTON (*Fuller 1358*).
- **Sisymbrium altissimum* L., tall tumble mustard. Occasional weed in gravel, especially on bird islands. There has been a population on Hog Island since at least 1905. GREEN (occasional). HAT (uncommon). CHAMBERS (*Ugent 1037*). LITTLE STRAWBERRY (rare). WASHINGTON (*13006*). HOG (*Goessl 3941, Fuller s.n.*, also present 1999). GULL (*89-178*).
- **S. officinale* (L.) Scop., hedge-mustard. Uncommon weed. ROCK (*12540*). LITTLE GULL (*89-157*).

**Thlaspi arvense* L., field pennycress. Occasional weed. LITTLE STRAWBERRY (uncommon). PLUM (13392). WASHINGTON (Fuller 1629). LITTLE SUMMER (13005).

CAMPANULACEAE (Bellflower Family)

Campanula aparinoides Pursh, marsh bellflower. Occasional, marshes. CHAMBERS (13933). PLUM (14091). DETROIT (rare, south tip). WASHINGTON (Fuller 1546). LITTLE SUMMER (rare).

**C. rapunculoides* L., creeping bellflower. Rarely spreading and persisting from cultivation. CHAMBERS (13769). WASHINGTON (rare).

C. rotundifolia L., harebell. Fairly common, dolomite rockshores and cliffs, dunes, and bird islands. SNAKE (uncommon). GREEN (13205). CANA (uncommon). HAT (uncommon). CHAMBERS (Ugent 1175). PLUM (13411). DETROIT (13434). PILOT (rare). WASHINGTON (Fuller 1458). HOG (rare). ROCK (Cochrane 5176). ST. MARTIN (89-099). POVERTY (uncommon). SUMMER (Tessene 72). LITTLE SUMMER (occasional).

CANNABACEAE (Indian Hemp Family)

Humulus lupulus L., common hops. Rare, Summer Island in 1969 (Bourdo 22565, MSC).

CAPRIFOLIACEAE (Honeysuckle Family)

Diervilla lonicera Mill., northern bush-honeysuckle. Common, woods and wooded dunes. CHAMBERS (13744). SPIDER (1905 collection, MIL). PLUM (uncommon). DETROIT (13509). WASHINGTON (Threlfall s.n., UWGB). ROCK (13652). ST. MARTIN (89-044). POVERTY (90-209). SUMMER (Voss 13383). LITTLE SUMMER (occasional).

Linnaea borealis L. subsp. *longiflora* (Torr.) Hultén, twinflower. Frequent, cedar-fir thickets near Lake Michigan. PLUM (13297). DETROIT (13551). WASHINGTON (Pohl 27, MIL). ST. MARTIN (89-040). POVERTY (uncommon). SUMMER (Tessene 8). LITTLE SUMMER (12929).

Lonicera canadensis Marshall, Canada fly honeysuckle. Occasional, woods. CANA (uncommon). PLUM (rare). DETROIT (13553). WASHINGTON (Fuller 1478). ROCK (13174). ST. MARTIN (89-004). SUMMER (12913).

L. dioica L., red honeysuckle. Occasional, especially in cedar-fir thickets near the coast. GREEN (13203). CHAMBERS (Ugent 1172). PLUM (13363). DETROIT (rare). WASHINGTON (Fewless & Moore 5916). ROCK (13172). ST. MARTIN (89-081). POVERTY (90-230). SUMMER (12895). LITTLE SUMMER (rare).

L. hirsuta Eaton, hairy honeysuckle. Occasional, woods. CHAMBERS (Ugent 1171). PLUM (rare). DETROIT (13544). WASHINGTON (Fuller 1385). ROCK (12523). ST. MARTIN (89-139). SUMMER (Voss 13384). LITTLE SUMMER (13003).

L. oblongifolia (Goldie) Hook., swamp fly honeysuckle. Rare, known only from the cedar swamp at Big Marsh on Washington Island (13067).

**L. X bella* Zabel, Bell's honeysuckle. Fairly common weedy species of woods and woods edges; not on the Michigan islands. SNAKE (common). GREEN (13247). CANA (occasional). CHAMBERS (13757). ADVENTURE (abundant). LITTLE STRAWBERRY (occasional). HORSESHOE (common). PLUM (13340). DETROIT (occasional). WASHINGTON (13013). ROCK (Cochrane 5186).

Sambucus canadensis L., American elder. Uncommon, bird islands. JACK (uncommon). LITTLE GULL (90-605). GULL (89-173).

S. racemosa L. subsp. *pubens* (Michx.) House, red-berried elder. Fig. 42. Common, woods; often abundant on bird islands. SNAKE (fairly common). GREEN (13222). CANA (occasional). HAT (occasional). CHAMBERS (Ugent 1174). ADVENTURE (common). LITTLE STRAWBERRY (fairly common). JACK (common). HORSESHOE (fairly common). SPIDER (reported in 1966). SISTER (common in 1977). PLUM (13428). DETROIT (common). PILOT (abundant). WASHINGTON (Fuller 1382). HOG (abundant). ROCK (Cochrane 5228). ST. MARTIN (89-073). GRAVELLY (Cranbrook Institute-Oakland University sight record). LITTLE GULL (Cranbrook Institute-Oakland University sight record). GULL (Cranbrook Institute-Oakland University sight record). POVERTY (90-208). SUMMER (Voss 12643). LITTLE SUMMER (fairly common).

Symphoricarpos albus (L.) S.F. Blake, snowberry. Occasional, wooded dunes, cedar-fir thickets, and dolomite rockshores. CANA (occasional). CHAMBERS (Ugent 1169). PLUM



FIGURE 42. West coast of Pilot Island, Wisconsin, which was invaded by colonial waterbirds in the 1980s and 1990s. The dead white cedar forest overtops a dense shrublayer of red-berried elder (*Sambucus racemosa* subsp. *pubens*) and red-osier dogwood (*Cornus stolonifera*), 22 July 1999.

- (13361). DETROIT (fairly common). WASHINGTON (Fuller 1409). ROCK (13178). POVERTY (89-276). SUMMER (Tessene 45). LITTLE SUMMER (occasional). *Viburnum acerifolium* L., maple-leaved viburnum. Uncommon, rich woods on the larger islands. WASHINGTON (Fuller 1557). ROCK (13162). *V. lentago* L., nannyberry. Uncommon, swamps. SNAKE (occasional). CHAMBERS (Ugent 1244). WASHINGTON (Fuller 1536). *V. opulus* L., highbush-cranberry. Occasional, edges and shores; locally common on bird islands. SNAKE (fairly common). GREEN (13241). CANA (occasional). ADVENTURE (fairly common). LITTLE STRAWBERRY (uncommon). SPIDER (1905 collection, MIL). WASHINGTON (Fewless 1502). ROCK (13110). ST. MARTIN (90-003).

CARYOPHYLLACEAE (Pink Family)

- **Arenaria serpyllifolia* L., thyme-leaved sandwort. A common small weed of dry sandy and gravelly trails and roadsides. CANA (rare). CHAMBERS (13729). PLUM (12674). DETROIT (13494). WASHINGTON (Fewless & Moore 5958). ST. MARTIN (90-515). GRAVELLY (89-145). POVERTY (90-240). SUMMER (Bourdo 22567, MSC). LITTLE SUMMER (12968). *A. stricta* Michx. subsp. *dawsonensis* (Britton) Maguire, northern rock sandwort. SPECIAL CONCERN (WI), as *Minuartia dawsonensis*. Found in 1998 on dunes on Washington Island at Jackson Harbor (Fuller 1571) and at Percy Johnson County Park on the east coast. **Cerastium fontanum* Baumg. subsp. *vulgare* (Hartm.) Greuter & Burdet, mouse-ear chickweed. Common weed. CANA (rare). CHAMBERS (Ugent 1015). SPIDER (1905 collection, MIL). PLUM (13405). DETROIT (13583). WASHINGTON (12651). ROCK (Cochrane 5175). ST. MARTIN (89-064). POVERTY (12802). SUMMER (Tessene 165). LITTLE SUMMER (12942).

- C. nutans* Raf., nodding chickweed. Occasional weed, especially on bird islands. SNAKE (occasional). CHAMBERS (13958). DETROIT (12796). PILOT (uncommon). WASHINGTON (12764). HOG (uncommon). ROCK (Cochrane 5192). GULL (89-185).
- **C. tomentosum* L., snow-in-the-summer. Locally common and long-persisting escape from cultivation on Rock Island (13020); also a small patch on adjacent Washington Island at Jackson Harbor (12525).
- **Dianthus armeria* L., Deptford pink. Rare escape. SNAKE (uncommon). WASHINGTON (Threlfall s.n., UWGB).
- **D. barbatus* L., sweet-William. Uncommon escape from cultivation. ROCK (Tans 801). POVERTY (90-268).
- **D. deltoides* L., maiden pink. Rare escape from cultivation. DETROIT (13454).
- **Lychnis coronaria* (L.) Desr., maiden-pink. Rare escape from cultivation. Reported by Fuller (1927) from St. Martin Island.
- **Petrorhagia saxifraga* (L.) Link, saxifrage pink. Locally common and long-persisting escape from cultivation on Rock Island (12492).
- **Saponaria officinalis* L., bouncing-bet. Occasional weed of roadsides. CANA (occasional). PLUM (14046). PILOT (occasional). WASHINGTON (Schutz 157, UWGB). ROCK (Griswold s.n., 2 Sept. 1974, WIS).
- **Silene antirrhina* L., sleepy-catchfly. Occasional weed, mostly of dry roadside gravel and dunes. CHAMBERS (13725). PLUM (14039). ROCK (13661). POVERTY (89-244).
- **S. armeria* L., sweet-William catchfly. Rare weed. POVERTY (89-233b).
- **S. cserei* Baumg., Balkan catchfly. Rare weed, Washington Island (Cochrane s.n., 1985).
- **S. latifolia* Poir. subsp. *alba* (Mill.) Greuter & Burdet, evening lychnis. Common weed. SNAKE (uncommon). GREEN (13271). CANA (occasional). HAT (occasional). CHAMBERS (Ugent 1262). ADVENTURE (rare). JACK (occasional). DETROIT (13554). PILOT (occasional). WASHINGTON (Fuller 1392). HOG (occasional). ROCK (13685). LITTLE GULL (90-618). GULL (Cranbrook Institute-Oakland University sight record). POVERTY (90-249). SUMMER (Tessene 69).
- **S. vulgaris* (Moench) Garcke, bladder-campion. Fairly common weed. CHAMBERS (13762). PLUM (13408). DETROIT (13520). WASHINGTON (Fuller 1407). ROCK (13678).
- Stellaria calycantha* (Ledeb.) Bong., northern starwort. Rare, wetlands, only from Summer Island (Voss 13370).
- S. graminea* L., common stitchwort. Rare, reported only from Poverty Island (Cranbrook Institute-Oakland University sight record).
- **S. media* (L.) Vill., common chickweed. Fairly common weed. CHAMBERS (Ugent 1018). WASHINGTON (Cochrane 11062). ROCK (Cochrane 5227). LITTLE GULL (Cranbrook Institute-Oakland University sight record). POVERTY (Cranbrook Institute-Oakland University sight record). SUMMER (Cranbrook Institute-Oakland University sight record).
- CELASTRACEAE (Bittersweet Family)**
- Celastrus scandens* L., climbing bittersweet. Occasional, woods and shoreline thickets. GREEN (13264). CHAMBERS (Ugent 1210). JACK (rare). PLUM (13291). DETROIT (13893). WASHINGTON (Fuller 1594). HOG (rare). ROCK (13114). SUMMER (Summer Harbor dunes, 12858).
- **Euonymus alata* (Thunb.) Siebold, winged euonymus. Rare escape from cultivation. WASHINGTON (Rose s.n., 1972, UWGB).
- CHENOPODIACEAE (Goosefoot Family)**
- **Chenopodium album* L., lamb's-quarters. Common weed, especially on bird islands. GREEN (occasional). HAT (occasional). CHAMBERS (Ugent 1014). JACK (fairly common). DETROIT (occasional). PILOT (occasional). WASHINGTON (Fuller 1362). HOG (occasional). LITTLE GULL (Cranbrook Institute-Oakland University sight record). GULL (Cranbrook Institute-Oakland University sight record). SUMMER (Taylor s.n., 1978, MSC).
- C. capitatum* (L.) Asch., strawberry-blite. Rare. WASHINGTON (road in heavily logged woods, 13701). HOG (Fuller 1508). SUMMER (Tessene 171).

- C. simplex* (Torr.) Raf., maple-leaved goosefoot. Uncommon weedy species of rich soil. SNAKE (uncommon). CHAMBERS (13938). WASHINGTON (13811).
- Cycloloma atriplicifolium* (Spreng.) J.M. Coul., winged pigweed. Rare in sand, Chambers Island in 1961 (*Ugent* 1180).
- **Salsola tragus* L., Russian thistle. Locally common weed on sandy beaches, Chambers Island (13909).

CONVOLVULACEAE (Morning-Glory Family)

- Calystegia sepium* (L.) R. Br., hedge bindweed. Fairly common, fields and dunes. CHAMBERS (*Ugent* 1179). DETROIT (13885). PILOT (occasional). WASHINGTON (13605). HOG (occasional). ROCK (occasional).
- **Convolvulus arvensis* L., field bindweed. Uncommon weed. SNAKE (occasional). CHAMBERS (13775). GULL (*Cranbrook Institute-Oakland University sight record*). POVERTY (89-241).

CORNACEAE (Dogwood Family)

- Cornus alternifolia* L.f., pagoda dogwood. Occasional in rich woods, mostly on the larger islands. CHAMBERS (*Ugent* 1179). DETROIT (13885). WASHINGTON (13605). ROCK (rare).
- C. amomum* Mill. var. *schuetzeana* (C.A. Mey.) Rickett, silky dogwood. Rare, Washington Island (*Threlfall s.n.*, UWGB).
- C. canadensis* L., bunchberry. Occasional, mostly in coniferous woods. WASHINGTON (*Fewless* 5510). ROCK (uncommon). POVERTY (89-240). SUMMER (*Tessene* 87).
- C. rugosa* Lam., round-leaved dogwood. Occasional to fairly common, woods, sometimes (as on Rock Island) a dominant large understory shrub in boreal forests; also on bird islands. GREEN (13235). CHAMBERS (*Ugent* 1201). PLUM (13311). DETROIT (13522). PILOT (occasional). WASHINGTON (*Fuller* 1506). ROCK (13121). ST. MARTIN (89-020). POVERTY (90-251). SUMMER (*Voss* 13364). LITTLE SUMMER (occasional).
- C. stolonifera* Michx., red-osier dogwood. Common, wetlands, dolomite rockshores, and bird islands. SNAKE (fairly common). GREEN (13260). CANA (abundant). HAT (occasional). CHAMBERS (*Ugent* 1200). ADVENTURE (common). LITTLE STRAWBERRY (occasional). JACK (common). HORSESHOE (uncommon). SISTER (common in 1970). SPIDER (1905 collection, MIL). PLUM (occasional). DETROIT (occasional). PILOT (abundant). WASHINGTON (*Fuller* 1444). HOG (fairly common). ROCK (13098). ST. MARTIN (89-131). GRAVELLY (*Cranbrook Institute-Oakland University sight record*). LITTLE GULL (90-607). GULL (*Cranbrook Institute-Oakland University sight record*). POVERTY (occasional). SUMMER (*Tessene* 48). LITTLE SUMMER (fairly common).

CRASSULACEAE (Stonecrop Family)

- **Sedum acre* L., gold-moss stonecrop. Becoming a troublesome weed on wet dolomite shorelines of several islands (the worst infestations appear to be at the south tips of islands). On Rock Island, becoming established on dolomite ledges up to seven meters above the lake (presumably dispersed there by waves or ice). CANA (common). CHAMBERS (13764). DETROIT (13557). WASHINGTON (*Fewless* 5516). ROCK (13676). ST. MARTIN (89-034). GRAVELLY (89-155). GULL (*Cranbrook Institute-Oakland University sight record*). POVERTY (90-285). SUMMER (fairly common, south tip). LITTLE SUMMER (fairly common).

CYPERACEAE (Sedge Family)

- Carex albursina* E. Sheld., white bear sedge. Rare, known only from rich hardwoods on Boyer Bluff, Washington Island (*Cochrane* 11044).
- C. aquatilis* Wahlenb., water sedge. Common, shallow marshes near the coast or even on sheltered shores of Lake Michigan (as on the west side of Little Summer Island). PLUM (13386). DETROIT (occasional, north bay). WASHINGTON (7 July 1905 collection, MIL). ROCK (*Cochrane* 5185). POVERTY (89-266). SUMMER (12863). LITTLE SUMMER (12973).
- C. arctata* Hook., drooping woodland sedge. Common, woods, including coastal conifer thickets. CHAMBERS (12738). PLUM (12685). DETROIT (occasional). WASHINGTON

- (*Fewless 5186*). ROCK (*Cochrane 5214*). ST. MARTIN (near cemetery, 90-529). SUMMER (12881). LITTLE SUMMER (12950).
- C. atherodes* Spreng., slough sedge. WASHINGTON (13083).
- C. aurea* Nutt., golden sedge. Occasional, alkaline rockshores and ditches, sometimes with *C. garberi*. CANA (uncommon). WASHINGTON (*Cochrane 11038*). ST. MARTIN (90-523). SUMMER (*Voss 13366*).
- C. backii* W. Boott, Rocky Mountain sedge. SPECIAL CONCERN (WI). Recent records from a hardwood forest on Boyer Bluff, Washington Island (*Cochrane 11056*), were not re-located (but not intensively looked for).
- C. bebbii* (L.H. Bailey) Fernald, Bebb's sedge. Occasional, moist areas. DETROIT (13546) WASHINGTON (*Fewless 5562*). ROCK (12535). ST. MARTIN (90-311). SUMMER (*Tessene 156*).
- C. blanda* Dewey, common wood sedge. Rare, rich hardwoods, known only from Mountain Park, Washington Island (*Cochrane 11125*).
- C. brevior* (Dewey) Lunell, fescue sedge. Local, known only from Great Lakes pine barrens on Chambers Island (*Ugent 1251, Judziewicz 13776*).
- C. brunnescens* (Pers.) Poir., brownish sedge. Uncommon, coniferous thickets. POVERTY (89-269). SUMMER (90-691).
- C. buxbaumii* Wahlenb., Buxbaum's sedge. Occasional, boreal fens and wet alkaline rockshores. WASHINGTON (*Fewless 5170*). POVERTY (12815). SUMMER (12892).
- C. canescens* L., silvery sedge. Rare; only noted in the cedar swamp at Big Marsh, Washington Island in 1999.
- C. capillaris* L., hairlike sedge. SPECIAL CONCERN (WI). Although not known from the Wisconsin islands, there is a recent record from coastal alvar on Poverty Island (90-252), Michigan. It was not seen there in 1998.
- C. castanea* Wahlenb., chestnut sedge. Occasional in cedar-fir thickets and swamps near the coast. WASHINGTON (12760). ROCK (13105).
- C. chordorrhiza* L.f., cord-root sedge. Rare, boreal fen on north end of Little Lake, Washington Island (13716).
- C. communis* L.H. Bailey, fibrous-root sedge. Frequent, upland woods. DETROIT (13598). WASHINGTON (*Goessl 3907*). ROCK (13129). ST. MARTIN (90-526). SUMMER (*Voss 12641*). LITTLE SUMMER (12981).
- C. concinna* R.Br., beautiful sedge. THREATENED (WI). This sedge was recently discovered from forested ridges and swales on Washington Island (Jackson Harbor Ridges) by Gary Fewless (5570). This species is rare in Wisconsin (Tans 1983, Judziewicz & Koch 1993), while in Michigan, this species is uncommon on alvar on Summer Island (mostly on the east coast; *Voss 12636*).
- C. crawei* Torr., Crawe's edge. SPECIAL CONCERN (WI). This sedge is fairly widespread in coastal alvar and Great Lakes alkaline rockshore communities. It is found on Detroit Island (south end, 12775), Washington Island (several places near the ferry dock; southeast coast; Jackson Harbor, *Fewless 5555*), Rock Island (borrow pit, 13138), and is frequent on Poverty (12823), Summer (*Voss 12615*), and Little Summer Islands (12917).
- C. crinita* Lam., fringed sedge. Uncommon, moist woods. WASHINGTON (14003). ROCK (*Tans 822*).
- C. deflexa* Hornem., northern oak sedge. Rare, conifer woods on Plum Island (13375).
- C. deweyana* Schwein., Dewey's sedge. Fairly common, woods. GREEN (13233). CHAMBERS (uncommon). PLUM (12676). DETROIT (13579). WASHINGTON (*Fewless 5185*). ROCK (12521). ST. MARTIN (90-761). POVERTY (12841). SUMMER (*Voss 13363*). LITTLE SUMMER (12967).
- C. diandra* Schrank, bog panicled sedge. Rare, boreal fens. WASHINGTON (Little Lake, 13027). SUMMER (shore of Southwest Bay, 12869).
- C. disperma* Dewey, two-seeded bog sedge. Uncommon, cedar or hardwood swamps. DETROIT (13463). WASHINGTON (*Fewless 5208*). SUMMER (12875).
- C. eburnea* Boott, ebony sedge. Abundant on dolomite bluffs under cedar; frequent just beyond the splash zone on alkaline rockshores. CHAMBERS (12719). HORSESHOE (uncommon). PLUM (12672). DETROIT (locally common). WASHINGTON (*Fewless*

- 5160). ROCK (12630). ST. MARTIN (89-051). POVERTY (89-254). SUMMER (Tessene 125). LITTLE SUMMER (12932).
- C. flava* L., yellow sedge. Uncommon, wet shores and wet borrow pits. WASHINGTON (Fuller 1548). ROCK (12536).
- C. garberi* Fernald, elk sedge. THREATENED (WI). This sedge is fairly widespread in coastal alvar and Great Lakes alkaline rockshore communities. There is a 15 June 1935 collection from "Jack Island Shoal" (Fassett & Thorpe 17759, WIS). It is found on Detroit Island (south end, 13565), Washington Island (several places near ferry dock; southeast coast; Jackson Harbor, *Cochrane* 11102), and Rock Island (borrow pit, 13137). It is frequent on the Michigan Islands (Poverty [12822], Summer [Voss 13387], Little Summer [12917a]).
- C. granularis* Willd., limestone meadow sedge. Occasional, calcareous meadows and rockshores. WASHINGTON (13008). POVERTY (89-268). SUMMER (12862).
- C. gynocrates* Drejer, northern bog sedge. SPECIAL CONCERN (WI). A large colony of this species was found in a cedar swamp near Big Marsh on Washington Island in 1999 (14001). Here it was locally the dominant groundcover, and all plants were female.
- C. hirtifolia* Mack., hairy sedge. Rare, rich, seeping old-growth beech-maple forest in the interior of Rock Island (12613).
- C. hitchcockiana* Dewey, Hitchcock's sedge. Rare, rich sugar maple woods on Little Summer Island (12961).
- C. houghtoniana* Torr., Houghton's sedge. Rare, old campfire ring near cabin on Summer Island (12886).
- C. hystericina* Willd., bottlebrush sedge. Common, ditches and alkaline rockshores. SNAKE (rare). CHAMBERS (13972). JACK (Fassett & Thorpe s.n., 15 June 1935, WIS). PLUM (13391). DETROIT (13574). WASHINGTON (*Cochrane* 11119). ROCK (12533). POVERTY (89-204). SUMMER (Tessene 167).
- C. intumescens* Rudge, bladder sedge. Occasional, mostly moist spots in hardwood forests. SNAKE (rare). CHAMBERS (13963). DETROIT (13483). WASHINGTON (13087). SUMMER (12904).
- C. lacustris* Willd., lake sedge. Uncommon, moist to inundated depressions. DETROIT (13474). WASHINGTON (13083).
- C. lasiocarpa* Ehrh. subsp. *americana* (Fernald) D. Löve & Bernard, narrow-leaved woolly sedge. Reported from Jackson Harbor Ridges dune ponds, Washington Island, by Gary Fewless.
- C. laxiflora* Lam., beech woods sedge. A common and characteristic species of beech-maple forests. CHAMBERS (12733). PLUM (13356). DETROIT (12785). WASHINGTON (*Cochrane* 11048). ROCK (13167). ST. MARTIN (89-045). POVERTY (12836). SUMMER (12879).
- C. leptalea* Wahlenb., bristle-stalked sedge. Uncommon, cedar swamps and alder thickets. DETROIT (13476). WASHINGTON (13060). SUMMER (12878).
- C. limosa* L., muck sedge. Rare, only from the boreal rich fen on the north side of Little Lake, Washington Island (13026).
- C. livida* (Wahlenb.) Willd. var. *radiculis* Paine, livid sedge. SPECIAL CONCERN (WI). Fairly common in two boreal fen communities on Washington Island (Coffee Swamp and Big Marsh, 13062).
- C. lupulina* Willd., hop sedge. Local in open vernal ponds/sedge meadows. WASHINGTON (13808). ST. MARTIN (90-321).
- C. magellanica* Lam., boreal bog sedge. Rare, boreal rich fen, Coffee Swamp, Washington Island (13084).
- C. muhlenbergii* Willd., Muhlenberg's sedge. Stabilized dunes on Green (13262) and Chambers (Ugent 1252) Islands.
- C. ormostachya* Wiegand, necklace-spike sedge. Uncommon in rich hardwoods. DETROIT (13576). WASHINGTON (14014). SUMMER (13177). LITTLE SUMMER (12958).
- C. Sect. Ovales*. PLUM (14086).
- C. peckii* Howe, Peck's sedge. Occasional, often in moist coniferous woods. SNAKE (uncommon). HORSESHOE (12695). PLUM (13309). DETROIT (12659, 12789). WASH-



FIGURE 43. Broad-leaved wood sedge (*Carex platyphylla*) in beech woods on Rock Island, Wisconsin, 10 June 1998. This mesophytic species of the eastern U.S. reaches its western range limit and is disjunct in Door County, Wisconsin.

- INGTON (Goessl 3993). ROCK (13171). SUMMER (Voss 12642). LITTLE SUMMER (13000).
- C. pedunculata* Willd., long-stalked sedge. Fairly common, mixed or more commonly coniferous woods. CHAMBERS (12709). PLUM (uncommon). DETROIT (13556). WASHINGTON (Fewless 5188). POVERTY (89-261). SUMMER (uncommon). LITTLE SUMMER (uncommon).
- C. pellita* Willd., broad-leaved woolly sedge. Locally common in marshes and shallow ponds. CHAMBERS (Ugent 1254, 13749). DETROIT (13585). WASHINGTON (13029, 13627). ROCK (13141). LITTLE SUMMER (12633).
- C. pensylvanica* Lam., Penn sedge. Locally dominant, forming sods in hardwood forest understories, especially on Chambers Island. CHAMBERS (Ugent 1253). PLUM (12680). DETROIT (fairly common). WASHINGTON (12650).
- C. plantaginea* Lam., plantain-leaved sedge. Rare, rich old-growth hardwoods. ROCK (13897). SUMMER (Freckmann sight record, 1976).
- C. platyphylla* J. Carey, broad-leaved wood sedge. Fig. 43. SPECIAL CONCERN (WI), THREATENED (MI). This eastern disjunct is found in small to large, dense colonies in old-growth to second-growth beech-sugar maple forests, often on tip-up mounds, where dolomite is near the surface (on the lip of small escarpments), or where leaf litter is thin (Cochrane 2000). All ten GTA sites were discovered during this inventory. On Washington Island (13049) it occurs in Mountain Tower Park and several private woodlots in the interior of the island. A large population of 500 plants occurs along the "prayer trail" to the beautiful wooden Norwegian church in the Stavkirke woods just northeast of "downtown". There are also several colonies on Rock Island (12640), the largest with over 1,000 plants. It is not known from the Michigan islands or anywhere in the Upper Peninsula, but is to be expected on the Garden Peninsula.
- C. prasina* Wahlenb., drooping sedge. Fig. 38. THREATENED (WI), no status (MI). This eastern woodland species was newly discovered in an ostrich fern-dominated seep in an

- old-growth beech-sugar maple forest on Rock Island (12498). It is not known from the Michigan islands or elsewhere in the Upper Peninsula.
- C. pseudocyperus* L., cypresslike sedge. Rare, vernal woodland pond on Summer Island (12872).
- C. radiata* (Wahlenb.) Small, eastern star sedge. Fairly common, rich woods. CHAMBERS (13931). PLUM (13303). DETROIT (13593). WASHINGTON (*Fewless* 5514). ST. MARTIN (90-593). SUMMER (12899). LITTLE SUMMER (12959).
- C. retrorsa* Schwein., retrorse sedge. Occasional, wetlands. SPIDER (*Fewless* 3173). DETROIT (13548). ST. MARTIN (90-302). SUMMER (*Tessene* 133).
- C. richardsonii* R. Br., Richardson's sedge. SPECIAL CONCERN (WI and MI). This prairie-barrens-alvar species is occasional in coastal alvar communities on Poverty (*Voice et al.* 82-007, MSC) and Summer (12860) Islands, Michigan. Locally a major dominant on alvars on the east coast of the Garden Peninsula (Albert *et al.* 1997).
- C. rosea* Willd., rosy sedge. Frequent in hardwood forests. CHAMBERS (13931). PLUM (13422). DETROIT (13533). WASHINGTON (*Cochrane* 11045). ROCK (13159). POVERTY (89-293). SUMMER (12899). LITTLE SUMMER (12959).
- C. sartwellii* Dewey, running marsh sedge. Local, marshes and sedge meadows. PLUM (13393, 13409). WASHINGTON (13628).
- C. sparganioides* Willd., bur-reed sedge. Rare in beech-maple forests. DETROIT (13533). WASHINGTON (Island Campground woods, 14015). ROCK (*Cochrane* 5215).
- **C. spicata* Huds., spiked bracted sedge. Rare, known from a sandy clearing ("Rutabaga Field") on Rock Island (12487). One of only a handful of Wisconsin sites for this species; in Michigan, it is known only from the "thumb" of the Lower Peninsula (Voss 1972).
- C. sprengelii* Spreng., Sprengel's sedge. Rare, rich sugar maple stand on Little Summer Island (12938).
- C. sterilis* Willd., fen star sedge. Locally common in fens, bogs, and wet alkaline rockshores. WASHINGTON (13030, 13066, *Goessl* 3973). SUMMER (12868, *Voss* 13373).
- C. stipata* Willd., common fox sedge. Occasional, wetlands. CANA (uncommon). JACK (*Fassett & Thorpe* 17740, WIS). DETROIT (13481). WASHINGTON (Coffee Swamp, 13053). LITTLE SUMMER (12989).
- C. stricta* Lam., tussock sedge. Occasional, marshes. CHAMBERS (*Ugent* 1265). WASHINGTON (*Goessl* 3935).
- C. tribuloides* Wahlenb., awl-fruited oval sedge. Rare, Summer Island (*Freckmann* 13180).
- C. trisperma* Dewey, three-fruited sedge. Rare, conifer swamp (Coffee Swamp), Washington Island (13078).
- C. tuckermanii* Dewey, Tuckerman's sedge. Rare, black ash swamp (Coffee Swamp), Washington Island (13056).
- C. umbellata* Willd., hidden sedge. Uncommon, dry sandy ground. CHAMBERS (12755). WASHINGTON (*Fewless* 5161, *Cochrane* 11100, 11089). ROCK (13659). SUMMER (12890). LITTLE SUMMER (12925).
- C. utriculata* Boott, bladder sedge. Rare, wetlands. SUMMER (*Freckmann* 13176).
- C. vesicaria* L., blister sedge. Rare, Coffee Swamp, Washington Island (13183).
- C. viridula* Michx., little green sedge. Frequent and characteristic species of wet alkaline shores and ditches. CHAMBERS (13720). JACK (*Fassett s.n.*, 1935, WIS). PLUM (14065). DETROIT (13566). WASHINGTON (*Fuller* 3908). ROCK (12493). POVERTY (89-293). SUMMER (13378).
- C. vulpinoidea* Michx., brown fox sedge. Rare, disturbed ground near Detroit Harbor, Washington Island (13630).
- Cladium mariscoides* (Muhl.) Torr., twig-rush. Known only from dune ponds at Jackson Harbor Ridges (*Fewless* 5501) and Big Marsh (13615) on Washington Island.
- Cyperus bipartitus* Torr., slender flat sedge. Rare, Washington Island (*Schutz* 142, UWGB).
- C. odoratus* L., fragrant cyperus. Rare, Jackson Harbor Ridges, Washington Island (*Fewless & Moore* 5914).
- Dulichium arundinaceum* (L.) Britton, three-way sedge. Marsh at Mud Lake, Chambers Island (13930).
- Eleocharis acicularis* (L.) Roem. & Schult., needle spikerush. Rare, alkaline rockshores. DETROIT (13865). WASHINGTON (13011). SUMMER (C.A. Long sight record, 1974).

- E. elliptica* Kunth, elliptic spikerush. Occasional, fens and wet alkaline rockshores. PLUM (14066). DETROIT (12777). WASHINGTON (Fuller 1420). ROCK (13133). POVERTY (12828). SUMMER (Voss 13375). LITTLE SUMMER (12920).
- E. erythropoda* Steud., bald spikerush. Rare, Chambers Island (13917).
- E. palustris* (L.) Roem. & Schult., common spikerush. Local in large puddles or shallow ponds and marshes. SNAKE (occasional). PLUM (14078). WASHINGTON (Fewless 5206). ST. MARTIN (pond near lighthouse, 90-306). SUMMER (Voss 13386).
- E. quinqueflora* (Hartman) Schwarz, few-flowered spikerush. SPECIAL CONCERN (WI). There are records from Great Lakes alkaline rockshores on Washington Island (Jackson Harbor Ridges, Fuller 3926; Percy Johnson County Park, Fewless et al. 5966, UWGB) and from alvars on Summer Island (Voss 13374), Michigan.
- Eriophorum alpinum* L., alpine cotton-grass. Occasional in Coffee Swamp boreal rich fen, Washington Island (13079).
- E. viridi-carinatum* (Englem.) Fernald, dark-scale cotton-grass. Fig. 26. Frequent in Coffee Swamp boreal rich fen, Washington Island (13063).
- Eriophorum virginicum* L., rusty cotton-grass. Rare, Coffee Swamp on Washington Island (13068).
- Rhynchospora capillacea* Torr., hairlike beakrush. Rare in dune pools and wet alkaline rockshores. DETROIT (13854). WASHINGTON (Jackson Harbor Ridges, Fewless 5564).
- Schoenoplectus acutus* (Bigelow) A. Löve & D. Löve, hardstem bulrush. Uncommon, marshes. WASHINGTON (Threlfall s.n., UWGB). SUMMER (90-750).
- S. pungens* (Vahl) Palla, common three-square bulrush. Occasional, shallow water of inland lakes, wet alkaline shorelines. CHAMBERS (Ugent 1134). PLUM (14074). DETROIT (13879). WASHINGTON (Fuller 1585). ROCK (12491).
- S. tabernaemontani* (C.C. Gmel.) Palla, softstem bulrush. Fig. 25. Locally common in marshes. SNAKE (fairly common). CHAMBERS (13914). PLUM (13377). DETROIT (13492). WASHINGTON (Fewless 5559). ROCK (13644).
- Scirpus cespitosus* L., tufted bulrush. Figs. 26, 44. THREATENED (WI). The only GTA occurrence is at Coffee Swamp on Washington Island, where the species is locally common in a boreal fen mat (13082).
- S. cyperinus* (L.) Kunth, wool-grass. Uncommon. WASHINGTON (Schutz 139, UWGB).

DROSERACEAE (Sundew Family)

- Drosera rotundifolia* L., round-leaved sundew. Rare, known only from sphagnum pockets under cedars in Coffee Swamp, Washington Island (Fuller 1449).

ELAEAGNACEAE (Oleaster Family)

- **Elaeagnus umbellata* Thunb., autumn-olive. Rare, a large shrub on a cedary dolomite shoreline on Cana Island (13277).
- Shepherdia canadensis* (L.) Nutt., buffalo-berry. Fig. 40. Occasional to frequent, gravelly shores, dolomite bluffs, and conifer thickets. SNAKE (rare). CHAMBERS (Ugent 1195). CANA (uncommon). PLUM (13400). DETROIT (13543). WASHINGTON (Fuller 1356). ROCK (Tans 814). ST. MARTIN (89-014). POVERTY (89-291). SUMMER (Tessene 4). LITTLE SUMMER (12994).

ERIACEAE (Heath Family)

- Andromeda glaucophylla* Link, bog-rosemary. Rare, wetlands, Washington Island (Schutz 77, UWGB).
- Arctostaphylos uva-ursi* (L.) Spring., bearberry. Occasional to locally common, stabilized dunes. CHAMBERS (12723). PLUM (13338). WASHINGTON (Fuller 1410). ROCK (G.J. Knudson sight record, 10-14 June 1964; not noted in 1997-1999). ST. MARTIN (89-012). POVERTY (Cranbrook Institute-Oakland University sight record). SUMMER (Voss 12620). LITTLE SUMMER (12997).
- Chamaedaphne calyculata* (L.) Moench var. *angustifolia* (Aiton) Rehder, leatherleaf. Known only from a pothole muskeg south of Mackaysee Lake, Chambers Island (12752).
- Epigaea repens* L., trailing-arbutus. Pine-oak woods near Mud Lake, Chambers Island (12731).



FIGURE 44. Tufted bulrush (*Scirpus cespitosus*), a species of cold alkaline rockshores and boreal fens, here in Coffee Swamp, Washington Island, Wisconsin, 4 June 1998.

Gaultheria hispidula (L.) Bigelow, creeping-snowberry. Rare, cedar swamps. WASHINGTON (Coffee Swamp, 13076). SUMMER (*Tessene* 106).

G. procumbens L., wintergreen. Infrequent in acid, sandy upland woods. CHAMBERS (12730). WASHINGTON (*Fuller* 1559). ROCK (12551).

Gaylussacia baccata (Wangenh.) K. Koch, huckleberry. Rare, acid sandy pine-oak woods near Mud Lake, Chambers Island (13737).

Ledum groenlandicum Oeder, Labrador-tea. Rare, wetlands. WASHINGTON (*Schutz* 84, UWGB). ROCK (G.J. Knudson sight record, 1964; not noted in 1997-1999).

Vaccinium angustifolium Aiton, early blueberry. Uncommon, dry upland woods and dunes. CHAMBERS (13738). DETROIT (13484). ROCK (12548).

V. myrtilloides Michx., velvetleaf blueberry. Uncommon, upland woods and dunes. DETROIT (13468). WASHINGTON (13713). ROCK (12550). SUMMER (12914).

V. oxycoccos L., small cranberry. Rare, observed only from sphagnous hummocks under cedars in Coffee Swamp, Washington Island.

EUPHORBACEAE (Spurge Family)

Chamaesyce maculata (L.) Small, wartweed. Uncommon weed of dry ground. CHAMBERS (13984). ROCK (12485).

C. polygonifolia (L.) Small, seaside spurge. Fig. 45. SPECIAL CONCERN (WI), as *Euphorbia polygonifolia*. This beach species appears to be declining because of development and increasing human disturbance. While locally common on Chambers Island (Sand Point, east coast dock, and south point, 13905, 13987), it is rare and barely persisting on both Washington Island (Dunes Park and Percy Johnson County Park, *Fewless & Moore* 5948) and Rock Island (south beach, *Fewless* 9983, UWGB).

**Euphorbia cyparissias* L., cypress spurge. Uncommon weed. SNAKE (fairly common). WASHINGTON (*Fuller* 1606).

**E. esula* L., leafy spurge. Uncommon weed. ADVENTURE (occasional). ST. MARTIN (89-006).



FIGURE 45. Mat of seaside spurge (*Chamaesyce polygonifolia*) on beach at south tip of Chambers Island, Wisconsin, 18 September 1998. This is the largest patch of this species I've seen in Door County! It is vulnerable to human foot and vehicular traffic.

FABACEAE (Bean or Pea Family)

Amphicarpaea bracteata (L.) Fernald, hog-peanut. Locally common in red oak woods near Sand Point, Chambers Island (*Ugent 1227*).

Lathyrus japonicus Willd. var. *maritimus* (L.) Kartesz & Gandhi, beach pea. Occasional, beaches; not on the Michigan Islands. CHAMBERS (*Ugent 1237*). SPIDER (1905 collection, MIL). PLUM (13285). DETROIT (13436). WASHINGTON (*Fuller 1552*). ROCK (*Cochrane 5198*).

**L. sylvestris* L., everlasting pea. Uncommon escape from cultivation. WASHINGTON (*Fuller 1371*).

L. ochroleucus Hook., pale vetchling. Occasional, dry (oak) to moist (cedar) woods. CHAMBERS (13920). WASHINGTON (*Goessl 3946*). ROCK (13175).

L. palustris L., marsh vetchling. Occasional, wet alkaline rockshores. PLUM (13378, 13330). DETROIT (13485, 13570). WASHINGTON (*Goessl 3923*). SUMMER (12845). LITTLE SUMMER (12921, 12930).

**Lotus corniculata* L., bird's-foot trefoil. Sight record by T.S. Cochrane on Washington Island.

**Medicago lupulina* L., black medick. Fairly common weed. SNAKE (rare). CANA (uncommon). CHAMBERS (*Ugent 1229*). PLUM (13413). DETROIT (13512). PILOT (rare). WASHINGTON (*Fewless & Moore 5951*). ROCK (12634). ST. MARTIN (89-141). GRAVELLY (*Cranbrook Institute-Oakland University sight record*). SUMMER (*Tessene 162*). LITTLE SUMMER (12993).

**M. sativa* L., alfalfa. Rare weed. WASHINGTON (*Schutz 62, UWGB*).

**Melilotus alba* Medik., white sweet-clover. Fairly common weed. SNAKE (uncommon). CHAMBERS (*Ugent 1233*). PLUM (occasional). DETROIT (uncommon). PILOT (uncommon). WASHINGTON (*Fuller 1366*). HOG (uncommon). ROCK (rare). SUMMER

- (Freckmann sight record, 1976). Sight records (*Cranbrook Institute-Oakland University*) from Little Gull and Gull Islands may refer to this species.
- **M. officinalis* (L.) Lam., yellow sweet-clover. Occasional weed. WASHINGTON (*Fuller 1498*). ROCK (*13649*).
- **Robinia pseudoacacia* L., black locust. There is a well-established but senescent grove (1998) near the main dock on Chambers Island (*Ugent 1236*).
- **Trifolium aureum* Pollich, yellow hop clover. Uncommon weed. WASHINGTON (*Rose 307*).
- **T. hybridum* L., Alsike clover. Fairly common weed. PLUM (*13415*). WASHINGTON (*13629*). ROCK (*13683*). SUMMER (*Tessene 70*).
- **T. pratense* L., red clover. Common weed. CANA (uncommon). CHAMBERS (*Ugent 1228*). SPIDER (1905 collection, MIL). PLUM (*13412*). DETROIT (occasional). WASHINGTON (*13015*). ROCK (*13144*). ST. MARTIN (*89-007*). LITTLE GULL (*Cranbrook Institute-Oakland University sight record*). SUMMER (Freckmann sight record, 1976).
- **T. repens* L. white clover. Common weed. CANA (uncommon). CHAMBERS (*Ugent 1230*). SPIDER (1905 collection, MIL). PLUM (*13406*). DETROIT (*13513*). WASHINGTON (*Schutz 179, UWGB*). ROCK (*13149*). ST. MARTIN (*90-540*). LITTLE GULL (*Cranbrook Institute-Oakland University sight record*). SUMMER (Freckmann sight record, 1976). LITTLE SUMMER (*12990*).
- Vicia americana* Willd., American vetch. Fairly common, woods, fields, and alkaline rock-shores. PLUM (*13330, 14087*). DETROIT (uncommon). WASHINGTON (*Goessl 3948*). ROCK (*13176*). POVERTY (*87-197*). SUMMER (*Voss 13390*).
- V. caroliniana* Walter, Carolina vetch. Rare, known only from a 15 June 1935 collection from a beech woods on Chambers Island (*Fassett 17373, WIS*).
- **V. sativa* L., common vetch. Uncommon weed. CHAMBERS (*Ugent 1234*). SUMMER (Freckmann sight record, 1976).
- **V. villosa* Roth, hairy vetch. Uncommon weed of old fields. PLUM (*13426*). WASHINGTON (*Schutz 18, UWGB*).

FAGACEAE (Beech Family)

- Fagus grandifolia* Ehrh., beech. Fig. 46. Common to dominant upland tree on the larger islands. CHAMBERS (*Ugent 1045*). DETROIT (rare). WASHINGTON (*Fuller 1495*). ROCK (*13161*). ST. MARTIN (*89-070*). POVERTY (rare, *12806*). SUMMER (occasional, *12630*). LITTLE SUMMER (fairly common).
- Quercus macrocarpa* Michx., bur oak. Rare, only one large tree noted in a swamp along Baseline Road in the interior of Chambers Island (*13960*).
- Q. rubra* L., red oak. Fig. 47. Occasional to common on the larger islands. CHAMBERS (locally common, *Ugent 1046*). PLUM (rare). DETROIT (occasional). WASHINGTON (locally common, *Fuller 1525*). ROCK (occasional, *13147*). ST. MARTIN (cliff area, *90-506*). SUMMER (occasional, *Tessene 180*).

FUMARIACEAE (Fumitory Family)

- Adlumia fungosa* (Aiton) Britton, Sterns & Poggenb., Allegheny-vine or climbing fumitory. SPECIAL CONCERN (WI and MI). This biennial herbaceous vine is found in upland woods, usually with dolomite bedrock or gravel at or near the surface. The seeds remain in the seedbank for many years and populations may appear suddenly after burning or excavation. It was found on several small islands: Little Strawberry (rare), Horseshoe (locally common). A population from Pilot Island (*Voice et al, 1982, MSC*) was not relocated. It is occasional in coastal cliff-top white cedar forests on Plum Island (*13354*); rare on a dolomite escarpment on Detroit Island (*13872*); uncommon on Washington Island, where it was found on Lobdells Point and along the east and north coasts (*13603*); and fairly common at the base of dolomite escarpments on Rock Island (*13165*). On the Michigan islands, climbing fumitory has been reported from St. Martin Island (*Fuller 1635, MIL*, plus several Cranbrook Institute-Oakland University collections), Summer Island (*Bourdo s.n., 9 Aug. 1968, MSC*), and Gull and Little Gull Islands (*Cranbrook Institute-Oakland University sight record*). In 1998 it was not relocated on Summer Island, and I did not visit the



FIGURE 46. Nearly pure stand of second-growth beech (*Fagus grandifolia*) near the west coast of Chambers Island (south of Sand Point), Wisconsin, 9 May 1998.



FIGURE 47. Second-growth red oak (*Quercus rubra*) stand near Sand Point on Chambers Island, Wisconsin. Hog-peanut (*Amphicarpaea bracteata*), smooth aster (*Aster laevis*), and wide-leaved panic-grass (*Panicum latifolium*) are found in the understory, 18 September 1998.

Gull Islands. Large new populations were located on Little Summer Island (12966), where they covered a graded, gravelly forest lane.

Corydalis aurea Willd., golden corydalis. Locally common and characteristic of gravelly sunny shorelines. SNAKE (uncommon). LITTLE STRAWBERRY (*Sequist s.n.*, 21 June 1947, WIS). PLUM (12987). DETROIT (12791). ST. MARTIN (*Fuller 1622*). GULL (89-175). LITTLE SUMMER (12977).

C. sempervirens (L.) Pers., pale corydalis. Uncommon, dolomite cliffs and gravel. ST. MARTIN (*Fuller 1623*). LITTLE SUMMER (12678).

Dicentra canadensis (Goldie) Walp., squirrel-corn. Uncommon in rich woods. LITTLE STRAWBERRY (a few plants in basswood forest on dolomite cobbles, 1998). ROCK (local in rich hardwoods along the Fernwood Trail, 12606).

D. cucullaria (L.) Bernh., dutchman's-breeches. Fig. 48. Locally common in rich mesic hardwoods. SNAKE (abundant). HAT (rare). LITTLE STRAWBERRY ("growing profusely all over," *Sequist s.n.*, 30 May 1947, WIS; uncommon in 1998). DETROIT (locally abundant, 12664). ROCK (occasional, 12625). LITTLE SUMMER (12956).

GENTIANACEAE (Gentian Family)

Gentianopsis procera (Holm) Ma, lesser fringed gentian. SPECIAL CONCERN (WI). This gentian is occasional but never abundant in Great Lakes alkaline rockshores and/or alvar. CANA (A. Jackson s.n., 27 Aug. 1945, WIS; not noted in 1998-1999). DETROIT (rare, south end, 13862). WASHINGTON (east coast and Jackson Harbor, *Tans 252*, MIL). SUMMER (*Tessene 13*).

Halenia deflexa (Sm.) Griseb., spurred-gentian. Uncommon, mostly in moist cedar-fir thickets near the coast. PLUM (*Tans 791*). WASHINGTON (7 July 1905 collection, MIL). POVERTY (89-248). SUMMER (*Tessene 155*). LITTLE SUMMER (fairly common).

GERANIACEAE (Geranium Family)

Geranium robertianum L., herb-Robert. A locally common and characteristic herb of dolomitic cedar forest understories, often on ledges or at the base of cliffs; but in many habitats, including bird islands. SNAKE (fairly common). GREEN (13231). CANA (rare). CHAMBERS (12759). ADVENTURE (occasional). LITTLE STRAWBERRY (occasional). JACK (uncommon). HORSESHOE (occasional). SPIDER (*Fewless 3176*). PLUM (13323). DETROIT (13510). PILOT (uncommon). WASHINGTON (fairly common). HOG (occasional). ROCK (*Cochrane 5205*). ST. MARTIN (89-111). GRAVELLY (*Cranbrook Institute-Oakland University sight record*). LITTLE GULL (*Cranbrook Institute-Oakland University sight record*). GULL (*Cranbrook Institute-Oakland University sight record*). POVERTY (12825). SUMMER (*Tessene 148*). LITTLE SUMMER (12975).

GROSSULARIACEAE (Gooseberry Family)

Ribes americanum Mill., American black currant. Fairly common, moist woods. Frequent on many bird islands. SNAKE (rare). GREEN (13232). CANA (*Cochrane 10459*, WIS). HAT (occasional). CHAMBERS (*Ugent 1044*). ADVENTURE (uncommon). LITTLE STRAWBERRY (*Sequist s.n.*, 21 June 1947, WIS). SPIDER (*Fewless 3170*). PLUM (occasional). DETROIT (13518). WASHINGTON (*Fuller 1493*). HOG (occasional). ST. MARTIN (89-093). GRAVELLY (89-159). LITTLE GULL (*Cranbrook Institute-Oakland University sight record*). GULL (*Cranbrook Institute-Oakland University sight record*).

R. cynosbati L., prickly wild gooseberry. Occasional, woods and fields. SNAKE (occasional). CHAMBERS (*Ugent 1043*). PLUM (fairly common). DETROIT (13518). WASHINGTON (*Fuller 1435*). ROCK (12617). SUMMER (*Freckmann 13166*).

R. glandulosum Grauer, skunk currant. Uncommon, swamps and conifer thickets. ADVENTURE (rare). WASHINGTON (*Fuller 1494*). POVERTY (rare in shaded rock crevices). SUMMER (*Voss 12633*).

R. hirtellum Michx., hairy-stemmed gooseberry. Rare. WASHINGTON (*Goessl 3917*).

R. hudsonianum Richardson, northern black currant. SPECIAL CONCERN (WI). This handsome shrub was found in a cedar swamp near Big Marsh on Washington Island in 1999 (14006).

R. lacustre (Pers.) Poir., bristly black currant. Uncommon; characteristic of moist, shaded cedar forests at the base of dolomite escarpments and scree slopes. CANA (rare). DE-



FIGURE 48. Abundant dutchman's-breeches (*Dicentra cucullaria*) in the understory of managed sugar maple (*Acer saccharum*) woods on central hill of Detroit Island, Wisconsin, 4 May 1998.

TROIT (12771). WASHINGTON (Fuller 1572). ROCK (12637). ST. MARTIN (Cranbrook Institute-Oakland University sight record). POVERTY (Cranbrook Institute-Oakland University sight record). SUMMER (Voss 12634). LITTLE SUMMER (rare).

HALORAGACEAE (Water-Milfoil Family)

Myriophyllum sibiricum Kom., common water-milfoil. This genus has been collected in the archipelago only by Gary Fewless (5575), on Washington Island.

Proserpinaca palustris L. var. *crebra* Fernald & Griscom, common mermaid-weed. Rare, shallow marly marshes (Coffee Swamp, Big Marsh) on Washington Island (13714).

HAMAMELIDACEAE (Witch-Hazel Family)

Hamamelis virginiana L., witch-hazel. Rare, known only from rich upland woods on Washington Island (Schutz 113, UWGB).

HYDROCHARITACEAE (Frog's-Bit Family)

Elodea canadensis Michx., common waterweed. In waters of Lake Michigan. POVERTY (90-212). SUMMER (Tessene 178).

E. nuttallii (Planch.) H. St. John, slender waterweed. Presumably from Lake Michigan. WASHINGTON (Schutz 59, UWGB).

Vallisneria americana Michx., eelgrass, water-celery. Shallow water. CHAMBERS (Lake Mackaysee, 13976). WASHINGTON (Fewless 5576).

HYDROPHYLLACEAE (Waterleaf Family)

Hydrophyllum virginianum L., Virginia waterleaf. Locally common in rich, older growth beech-maple woods in the interior of Rock Island (13169). Also occasional on Snake Island.

HYPERICACEAE (St. John's-wort Family)

Hypericum kalmianum L., Kalm or shrubby St. John's-wort. Fig. 51. Locally common and characteristic of calcareous swamps and wet alkaline rockshores; also in calcareous dry gravelly old fields and pastures. PLUM (14052). DETROIT (13511). WASHINGTON (Fuller 1472). POVERTY (89-199). SUMMER (Bourdo s.n., MSC). LITTLE SUMMER (12924).

H. majus (A. Gray) Britt., small St. John's-wort. Rare, meadow at Carp Lake on Plum Island (14060). Also uncommon on Snake Island.

**H. perforatum* L., common St. John's-wort or prozac-weed. Fairly common weed. CANA (occasional). ADVENTURE (uncommon). CHAMBERS (Ugent 1225). PLUM (13414). DETROIT (occasional). WASHINGTON (Fuller 1431). ROCK (13691). SUMMER (Tessene 144).

Triadenum fraseri (Spach) Gleason, marsh St. John's-wort. Rare, marshes and bogs. CHAMBERS (Mud Lake, 13934). WASHINGTON (Threlfall s.n., UWGB).

IRIDACEAE (Iris Family)

Iris lacustris Nutt., dwarf lake iris. Fig. 49. THREATENED (WI and MI). FEDERALLY LISTED. Locally common in white cedar-dominated swales near coasts: Plum Island (north coast, 13360), Detroit (west coast, 12787), Washington (southeast coast; abundant at Jackson Harbor, Fuller 1680), St. Martin (reported from near the lighthouse on the north-east coast by Fuller [1927]); Poverty (89-187) and Summer Islands (common on east and south coasts, Hagenah et al. 6691, MSC), and Little Summer Island (rare, east coast, 12927).

**I. pseudacorus* L., yellow flag. Rare escape from cultivation. WASHINGTON (Threlfall s.n., UWGB).

I. versicolor L., northern blue flag. Common, wetlands. CHAMBERS (Ugent 1064). PLUM (13387). DETROIT (13473). WASHINGTON (Fewless & Moore 5960). POVERTY (Cranbrook Institute-Oakland University sight record). SUMMER (Tessene 9). LITTLE SUMMER (rare).



FIGURE 49. Dwarf lake iris (*Iris lacustris*) on Great Lakes alkaline rockshore on the east coast of Little Summer Island, Michigan, 29 May 1998.

Sisyrinchium montanum Greene, mountain blue-eyed grass. Locally common, wet alkaline rockshores; also old fields, calcareous gravelly dunes. PLUM (13331). DETROIT (13435). WASHINGTON (Goessl 3940). ROCK (13103). POVERTY (12813). SUMMER (12865).

JUGLANDACEAE (Walnut Family)

Carya cordiformis (Wangenh.) K. Koch, bitternut or yellowbud hickory. Uncommon in oak woods near the lighthouse and in the northeast part of Chambers Island (Ugent 1054).

Juglans cinerea L., butternut. "TRACKED" (WI). Listed as common on Washington Island by Fuller (1927), it is now uncommon to rare on that island, found mostly in the Little Lake, Mountain Tower and Washington Harbor areas (13793). Only one mature tree was seen, and it was diseased.

JUNCACEAE (Rush Family)

Juncus alpinoarticulatus Chaix subsp. *nodulosus* (Wahlenb.) Hamet-Ahti, northern green rush. Occasional, wet alkaline rockshores. DETROIT (13882). WASHINGTON (Fuller 1419). POVERTY (89-273). SUMMER (Voss 13377).

J. arcticus Willd. subsp. *littoralis* (Engelm.) Hultén, baltic rush. Fig. 50. Common on wet alkaline rockshores. CHAMBERS (Ugent 1077). PLUM (13281). DETROIT (common, south tip). WASHINGTON (Fuller 1427). ROCK (13139). ST. MARTIN (90-590). POVERTY (89-280). SUMMER (Tessene 71). LITTLE SUMMER (abundant in shallow water, west coast, in 1998).

**J. articulatus* L., jointed rush. Rare, wet areas on beach of Summer Island (Freckmann 13186).

J. brachycephalus (Engelm.) Buchenau, short-headed rush. Rare. WASHINGTON (Fewless & Moore 5944, UWGB).

J. brevicaudatus (Engelm.) Fernald, narrow-panicked rush. Fairly common, shorelines. CHAMBERS (13721, 13982). DETROIT (13851). WASHINGTON (Little Lake, 13033). ROCK (12490, 13101).

J. bufonius L., toad rush. Rare. Detroit Harbor, Washington Island (13631).



FIGURE 50. Muddy, marly shore of Lake Michigan on sheltered east coast of Little Summer Island. The dominant plant here is Baltic rush (*Juncus arcticus* subsp. *littoralis*); silverweed (*Argentina anserina*) is also common, 29 May 1998.

J. canadensis LaHarpe, Canadian rush. Rare. Detroit Harbor, Washington Island (13033).

J. dudleyi Wiegand, Dudley's rush. Occasional, wetlands and shores. SNAKE (uncommon). CHAMBERS (13947). DETROIT (13567). WASHINGTON (Fuller 5558). ROCK (12531). POVERTY (89-225). SUMMER (Tessene 157).

J. effusus L., common rush. Rare, wetlands. SNAKE (uncommon).

J. nodosus L., joint rush. Uncommon, wetlands. SNAKE (rare). DETROIT (13881). WASHINGTON (Fuller 1426).

J. tenuis Willd., path rush. Occasional, trails and shores. CANA (uncommon). SUMMER (Freckmann 13183).

JUNCAGINACEAE (Arrow-Grass Family)

Triglochin maritimum L., common bog-arrow grass. SPECIAL CONCERN (WI). Apparently the first site for the GTA was found in 1998 on Washington Island at Big Marsh, where it is frequent in an emergent bulrush community at the margin of a shallow marly pond.

T. palustre L., marsh bog-arrow grass. SPECIAL CONCERN (WI). This arrow-grass is found in the swales of "forested ridge and swale" communities (Jackson Harbor Ridges, Washington Island, Fuller 1428), and also in shallow pools in shoreline dolomite communities (Summer Island, Michigan, Tessene 172).

LAMIACEAE (Mint Family)

**Acinos arvensis* (Lam.) Dandy, basil-thyme. Occasional weed. PLUM (13284). DETROIT (13443). WASHINGTON (field near Coffee Swamp in 1974, Tans s.n.; Jackson Harbor, Fewless 5217).

Agastache scrophulariaefolia (Willd.) Kuntze, figwort giant hyssop. Rare, hardwood forest on Lobdells Point, Washington Island (13705).

Calamintha arkansana (Nutt.) Shinnars, low calamint; summer savory [local name on Washington Island]. SPECIAL CONCERN (WI). Significant populations occur on Great Lakes alkaline rockshore communities on Detroit Island (south end; 13852, Alverson 1260) and



FIGURE 51. Water snake (*Nerodia sipedon sipedon*) "guarding" a plant of shrubby St. John's-wort (*Hypericum kalmianum*) on a dolomite ledge on southeast coast of Washington Island, Wisconsin, 21 July 1999.

- Washington Island (southeast coast and Jackson Harbor Ridges, *Fuller 1470*). In Michigan the species is common in similar habitats on Poverty Island (*12828a*), Summer Island (*Voss 13376*), and Little Summer Island (occasional), mostly on eastern coast alvars.
- Clinopodium vulgare* L., wild-basil. Fairly common weed. GREEN (*13246*). CANA (uncommon). PLUM (*14054*). DETROIT (*13514*). WASHINGTON (*Rose 279, UWGB*). ROCK (*Cochrane 5191*). ST. MARTIN (*89-048*). POVERTY (uncommon). SUMMER (*Tessene 28*). LITTLE SUMMER (rare).
- **Galeopsis ladanum* L. var. *angustifolia* (Hoffm.) Wallr., hemp-nettle. Uncommon weed. DETROIT (*Threlfall s.n., UWGB*). WASHINGTON (*13042*).
- **G. tetrahit* L., common hemp-nettle. Uncommon weed. CANA (uncommon). LITTLE SUMMER (*13001*).
- **Glechoma hederacea* L., gill-over-the-ground. Occasional weed, especially in lawns. SNAKE (abundant). CHAMBERS (*12739*). WASHINGTON (*Goessl 3939*). ST. MARTIN (*90-537*). POVERTY (*89-292*). SUMMER (*12915*).
- **Leonurus cardiaca* L., motherwort. Occasional weed; can be abundant on bird islands. CANA (abundant). LITTLE STRAWBERRY (uncommon). HORSESHOE (common). DETROIT (*13451*). WASHINGTON (*Fuller 1595*). HOG (occasional).
- Lycopus americanus* W.P.C. Barton, common water-horehound. Fairly common, swamps and wet alkaline rockshores. SNAKE (uncommon). CANA (uncommon). CHAMBERS (*Ugent 1150*). PLUM (*Ugent 14073*). DETROIT (*13504*). WASHINGTON (*Fuller 1412*). ROCK (*12542*). POVERTY (*89-196*). SUMMER (*Tessene 43*). LITTLE SUMMER (uncommon).
- L. uniflorus* Michx., northern bugleweed. Fairly common, wetlands and shores. SNAKE (uncommon). CHAMBERS (*Ugent 1163*). DETROIT (*13878*). WASHINGTON (*13075*). POVERTY (uncommon). SUMMER (*Tessene 42*).
- Mentha arvensis* L. var. *canadensis* (L.) Kuntze, wild mint. Occasional, swamps and shores. SNAKE (uncommon). CANA (uncommon). CHAMBERS (*13722*). DETROIT (*13477*).

WASHINGTON (Fuller 1537). POVERTY (12818). SUMMER (Tessene 66). LITTLE SUMMER (uncommon).

**M. X piperita* L., peppermint. Rare weed. WASHINGTON (13800).

**Monarda didyma* L., scarlet bee balm. Rare escape from cultivation; noted by Fuller in 1926 on Washington Island.

M. fistulosa L., bee balm. Fairly common, old fields and roadsides. SNAKE (occasional). GREEN (13257). CHAMBERS (Ugent 1193). HORSESHOE (uncommon). DETROIT (uncommon, Rabbit Point). WASHINGTON (Fuller 1617). ROCK (13824). SUMMER (Tessene 142). LITTLE SUMMER (12995).

M. punctata L., horsemint. Only from Great Lakes pine barrens on north bay of Chambers Island (Ugent 1190).

**Nepeta cataria* L., catnip. Fairly common weed, abundant on some bird islands. SNAKE (fairly common). GREEN (13201). HAT (abundant). CHAMBERS (Ugent 1188). ADVENTURE (uncommon). LITTLE STRAWBERRY (uncommon). JACK (common). HORSESHOE (uncommon). PLUM (13407). DETROIT (occasional). PILOT (abundant). WASHINGTON (Fuller 1501). HOG (common). ROCK (rare). GRAVELLY (Taylor s.n., MSC). LITTLE GULL (89-147). GULL (Cranbrook Institute-Oakland University sight record). POVERTY (12840). SUMMER (12849). LITTLE SUMMER (uncommon).

Prunella vulgaris L., heal-all. Fairly common, fields, roadsides, shorelines. CHAMBERS (13772). DETROIT (13560). WASHINGTON (Fuller 1387). ROCK (13563). ST. MARTIN (89-029). POVERTY (Cranbrook Institute-Oakland University sight record). SUMMER (Tessene 11). LITTLE SUMMER (occasional).

**Salvia aurea* Lam. var. *grandiflora* Benth., azure sage. Rare weed. CHAMBERS (13991). WASHINGTON (Fuller 1370).

Scutellaria galericulata L., common skullcap. Uncommon, wetlands. CHAMBERS (13965). PLUM (14090). DETROIT (uncommon). WASHINGTON (Fuller 1450).

S. lateriflora L., mad-dog skullcap. Uncommon, wetlands. CHAMBERS (13957). WASHINGTON (Schutz 134, UWGB). SUMMER (Tessene 92).

Stachys palustris L., marsh hedge-nettle. Uncommon, wetlands. PLUM (13395). DETROIT (13496). WASHINGTON (Fewless & Moore 5933).

S. tenuifolia Willd., smooth hedge-nettle. Uncommon, wetlands. SNAKE (uncommon). CHAMBERS (Ugent 1138). WASHINGTON (Schutz 90, UWGB).

Teucrium canadense L., germander. Rare, wetlands on Detroit Island (13857).

**Thymus praecox* Opiz subsp. *arcticus* (Durand) Jalas, creeping thyme. A locally common escape on Rock Island, where it is known locally as "Icelandic thyme" (12524).

LEMNACEAE (Duckweed Family)

Lemna minor L., common duckweed. Occasional floating aquatic. SNAKE (occasional). CHAMBERS (Mackaysee Lake, 13954). SUMMER (12976.5).

LENTIBULARIACEAE (Bladderwort Family)

Utricularia cornuta Michx., horned bladderwort. Rare, ponds. WASHINGTON (probably from Jackson Harbor Ridges, Fuller 1491).

U. geminiscapa Benj., hidden-fruited bladderwort. SPECIAL CONCERN (WI). There is a 1972 sight record by Ted Cochrane from an ephemeral dune pond on Carlin Point, Jackson Harbor Ridges, Washington Island. It has not been relocated since.

LILIACEAE (Lily Family)

Allium tricoccum Aiton, wild leek. Figs. 2, 52. Locally common in rich mesic upland hardwood forests. SNAKE (occasional). PLUM (rare). DETROIT (common, 13521). WASHINGTON (Fuller 1608). ROCK (abundant, 12601). ST. MARTIN (90-595). SUMMER (Voss 12638). LITTLE SUMMER (12946).

**Asparagus officinalis* L., asparagus. Occasional escape from cultivation. CHAMBERS (Ugent 1074). PLUM (13296). WASHINGTON (Schutz 6, UWGB). ROCK (13651).

Clintonia borealis (Aiton) Raf., bluebead, corn-lily. Occasional, mostly in cool coniferous woods. CHAMBERS (12744). PLUM (13320). WASHINGTON (Fuller 1474). ROCK (13116). ST. MARTIN (89-075).



FIGURE 52. John Kubisiak on the Fernwood Trail through the old-growth beech (*Fagus grandifolia*) and sugar maple (*Acer saccharum*) stand in the interior of Rock Island, Wisconsin. Wild leeks (*Allium tricoccum*), Carolina spring-beauty (*Claytonia caroliniana*), Virginia waterleaf (*Hydrophyllum virginianum*), and dutchman's-breeches (*Dicentra cucullaria*) are common in the understory, 15 May 1999.

**Convallaria majalis* L., European wild lily-of-the-valley. Occasionally spreading from cultivation, often near lighthouses. CANA (occasional). PLUM (13344). WASHINGTON (Cochrane 11078).

Erythronium americanum Ker Gawl., yellow trout-lily. Locally common in rich upland hardwood forests. CHAMBERS (12734). LITTLE STRAWBERRY (rare). PLUM (12682). DETROIT (fairly common). WASHINGTON (12655). ROCK (12607).

**Hemerocallis fulva* (L.) L., orange day-lily. Persisting and spreading from cultivation. CHAMBERS (Ugent 1073). PLUM (local). PILOT (local).

Lilium philadelphicum L., wood lily. Uncommon; a characteristic species of coastal cedar-fir thickets, dune forests, and alkaline rockshores that may be declining. CHAMBERS (Ugent 1076). ADVENTURE (*Bruncken s.n.*, 16 July 1897, MIL). SPIDER (1 July 1905 collection, MIL). PLUM (9 July 1905 collection, MIL). WASHINGTON (*Fuller 1394*). ROCK (G.J. Knudson sight record, 10-14 June 1964; not noted in 1997-1999). ST. MARTIN (89-022). POVERTY (*Cranbrook Institute-Oakland University sight record*). SUMMER (Tessene 160).

Maianthemum canadense Desf., Canada mayflower. Common, woods. SNAKE (occasional). GREEN (13275). CANA (fairly common). CHAMBERS (Ugent 1071). ADVENTURE (uncommon). HORSESHOE (fairly common). SPIDER (1905 collection, MIL). PLUM (13371). DETROIT (13555). WASHINGTON (13017). ROCK (13163). ST. MARTIN (90-514b). LITTLE GULL (90-609). POVERTY (*Cranbrook Institute-Oakland University sight record*). SUMMER (*Cranbrook Institute-Oakland University sight record*). LITTLE SUMMER (abundant).

Medeola virginiana L., Indian cucumber-root. SPECIAL CONCERN (WI). Collected from somewhere on Washington Island on 2 July 1931 by John J. Davis (WIS), and not seen

since. This species may be adversely affected by deer herbivory. There are no recent records from any of the Wisconsin counties bordering Lake Michigan proper.

**Muscari botryoides* (L.) Mill., grape-hyacinth. Long-persisting and slightly spreading from cultivation. DETROIT (locally common in north tip field). WASHINGTON (*Rose 321*, UWGB).

Polygonatum pubescens (Willd.) Pursh, Solomon's-seal. Fairly common, woods. SNAKE (uncommon). GREEN (*13276*). CHAMBERS (*Ugent 1069*). SPIDER (1905 collection, MIL). PLUM (*13307*). DETROIT (*13595*). WASHINGTON (*Fuller 1383*). ROCK (*13164*). ST. MARTIN (*90-072*). GULL (*Cranbrook Institute-Oakland University sight record*). POVERTY (*Cranbrook Institute-Oakland University sight record*). SUMMER (*12883*). LITTLE SUMMER (*12951*).

Smilacina racemosa (L.) Desf., false Solomon's-seal. Occasional, upland woods. SNAKE (occasional). GREEN (*13234*). CHAMBERS (*Ugent 1066*). ADVENTURE (*Bruncken s.n.*, 11 July 1905, MIL). LITTLE STRAWBERRY (rare). HORSESHOE (uncommon). SPIDER (1 July 1905 collection, MIL). PLUM (*13349*). DETROIT (*13530*). WASHINGTON (*Fuller 1378*). HOG (rare). ROCK (*13112*). ST. MARTIN (*89-121*).

S. stellata (L.) Desf., starry false Solomon's-seal. Fairly common, cedar-fir thickets, wooded dunes, and alkaline rockshores. GREEN (*13263*). CANA (occasional). HAT (rare). CHAMBERS (*Ugent 1068*). ADVENTURE (uncommon). LITTLE STRAWBERRY (uncommon). PLUM (*13362*). DETROIT (*13587*). WASHINGTON (*Fuller 1403*). ROCK (*Cochrane 5194*). ST. MARTIN (*90-025*). POVERTY (occasional). SUMMER (*12859*). LITTLE SUMMER (rare).

S. trifolia (L.) Desf., swamp false Solomon's-seal. Rare, wetlands. WASHINGTON (*Schutz 80*, UWGB).

Streptopus roseus Michx. var. *longipes* (Fernald) Fassett, rosy twisted-stalk. Occasional, woods. CHAMBERS (*12745*). PLUM (rare). DETROIT (*13596*). WASHINGTON (*Fuller 1503*). ROCK (*Cochrane 5223*). ST. MARTIN (*89-067*). SUMMER (rare, *12901*). LITTLE SUMMER (*12982*).

Tofieldia glutinosa (Michx.) Pers., false asphodel. THREATENED (WI). False-asphodels prefer fens, the swales in forested ridge and swale communities, and creviced dolomite shorelines. This species was abundant in 1998 at long-known sites on Washington Island (Coffee Swamp and Jackson Harbor, *Fuller 1541*); a small new population was also found on southeastern coast Great Lakes alkaline rockshore. It is also present on east coast alvars on Poverty Island (*89-161*) and is rare on Summer Island, Michigan.

Trillium cernuum L., nodding trillium. Uncommon, mostly in conifer swamps. SNAKE (rare). WASHINGTON (*Fuller 1504*). POVERTY (*89-234*). SUMMER (rare, *12900*). LITTLE SUMMER (*12979*).

T. grandiflorum (Michx.) Salisb., great-flowered trillium. Fairly common, upland woods. GREEN (*13238*). CHAMBERS (*Ugent 1072*). HORSESHOE (uncommon). PLUM (*12667*). DETROIT (*13538*). WASHINGTON (*Rose 315*, UWGB). ROCK (*12616*). ST. MARTIN (*89-057*).

Uvularia grandiflora Sm., great-flowered bellwort. Local and uncommon, rich upland hardwoods. CHAMBERS (near lighthouse, *Ugent 1065*). WASHINGTON (*Fuller 1528*). ROCK (G.J. Knudson sight record, 10-14 June 1964; not noted in 1997-1999).

Zigadenus elegans Pursh subsp. *glauca* (Nutt.) Hult  n, death camas, white camas. Locally common on wooded dunes, alkaline rockshores, and on the lips of dolomite bluffs under white cedar. DETROIT (*13563*). PLUM (*Tans 795*). WASHINGTON (*Fuller 1512*). ROCK (*12506*). GULL (*Cranbrook Institute-Oakland University sight record*). POVERTY (fairly common). SUMMER (*Bourdo 20060*, MSC). LITTLE SUMMER (uncommon).

LINACEAE (Flax Family)

**Linum perenne* L., wild blue flax. Escaped in a field near "downtown" Washington Island (*13036*).

LOBELIACEAE (Lobelia Family)

Lobelia inflata L., Indian-tobacco. Rare, logging lane on Chambers Island (*13948*).

- L. kalmii* L., brook lobelia. Fig. 22. Locally common and characteristic of alkaline shorelines. CANA (uncommon). PLUM (14058). DETROIT (13855). WASHINGTON (Fuller 1584). ROCK (12488). SUMMER (Tessene 26).
- L. siphilitica* L., great blue lobelia. Uncommon, moist woods edges and shorelines. SNAKE (rare). DETROIT (13880). WASHINGTON (Rose 302, WIS).
- L. spicata* Lam., pale-spike lobelia. Rare. ADVENTURE (Bruncken s.n., 16 July 1897). WASHINGTON (Schutz 47, UWGB).

LYTHRACEAE (Loosestrife Family)

- **Lythrum salicaria* L., purple loosestrife. As yet rare in 1998, only a few plants seen at Sand Point on Chambers Island (13910).

MALVACEAE (Mallow Family)

- **Malva moschata* L., musk mallow. Rare weed. WASHINGTON (Threlfall s.n., UWGB).
- **M. neglecta* Wallr., common mallow or cheeses. Occasional weed, sometimes fairly common on bird islands. HAT (common). JACK (occasional). SPIDER (Fewless 3166). PILOT (occasional). WASHINGTON (Schutz 125, UWGB). HOG (occasional). GRAVELLY (Taylor s.n., 1978, MSC).

MENYANTHACEAE (Buckbean Family)

- Menyanthes trifoliata* L., bogbean or buckbean. Uncommon in ponds and bogs. DETROIT (black ash swamp near north end, 13472). WASHINGTON (Little Lake fen; seen there in 1926 and 1998); SUMMER (north end, in wetlands, 90-772).

MOLLUGINACEAE (Carpetweed Family)

- **Mollugo verticillata* L., carpetweed. Weed in old sandy clearing (Rutabaga Field) on Rock Island (12549).

MONOTROPACEAE (Indian-pipe Family)

- Monotropa hypopithys* L., pinesap. Rare, woods. SUMMER (Tessene 163).
- M. uniflora* L., Indian-pipes. Occasional, woods. CHAMBERS (Ugent 1203). WASHINGTON (Fuller 1406). ROCK (12631). SUMMER (Tessene 22).

MYRICACEAE (Bayberry Family)

- Myrica gale* L., sweet gale. Rare in boreal fens and on wet alkaline shorelines. WASHINGTON (Fuller 1550). POVERTY (89-198).

NAJADACEAE (Naiad Family)

- Najas flexilis* (Willd.) Rostk. & W.L.E. Schmidt, slender naiad. Aquatic in Mackaysee Lake, Chambers Island (13973).

NYMPHAEACEAE (Water-Lily Family)

- Nuphar variegata* Durand, bullhead pond-lily. Fig. 8. Locally common in ponds. SNAKE (rare). CHAMBERS (Mud Lake, 13932). PLUM (common in Carp Lake in 1999). WASHINGTON (common in pond in Coffee Swamp in 1998; Fuller 1437).

OLEACEAE (Olive Family)

- Fraxinus americana* L., white ash. Rare forest tree on Washington Island (Goessl 3912 in 1916; not seen in 1998-1999).
- F. nigra* Marshall, black ash. Fig. 53. Occasionally forming interior hardwood swamps, as at Coffee Swamp, Little Marsh, and Big Marsh on Washington Island. SNAKE (uncommon). DETROIT (13456). WASHINGTON (Fewless 5200). SUMMER (Voss 12631).
- F. pennsylvanica* Marshall, green ash. Common tree, often present on shores as a seedling or sapling. GREEN (13200). CANA (uncommon). HAT (uncommon). CHAMBERS (13986). ADVENTURE (uncommon), LITTLE STRAWBERRY (uncommon), JACK (occasional). HORSESHOE (occasional). PLUM (14040). DETROIT (uncommon). WASHINGTON (Fuller 1465). ROCK (12672). ST. MARTIN (90-531). POVERTY (12826). SUMMER (Voss 13372). LITTLE SUMMER (occasional).



FIGURE 53. Black ash (*Fraxinus nigra*) swamp on north side of Coffee Swamp, Washington Island, Wisconsin, 4 June 1998.

**Syringa vulgaris* L., common lilac. Often persisting near lighthouses. GREEN (local, east tip). CANA (occasional). LITTLE STRAWBERRY (rare). PLUM (local). PILOT (local). WASHINGTON (*Schutz 178*, UWGB). ROCK (local). ST. MARTIN (90-534). POVERTY (local).

ONAGRACEAE (Evening-Primrose Family)

Circaea alpina L., small enchanter's-nightshade. Occasional, moist often coniferous woods. CANA (occasional). WASHINGTON (*Fuller 1433*). ROCK (*Threlfall s.n.*, UWGB). POVERTY (90-210). SUMMER (*Tessene 100*). LITTLE SUMMER (fairly common).

C. lutetiana L. subsp. *canadensis* (L.) Asch. & Magnus, broad-leaved enchanter's-nightshade. Fairly common in rich upland woods; not on the Michigan Islands. SNAKE (fairly common). GREEN (13219). CANA (rare). CHAMBERS (*Ugent 1197*). ADVENTURE (uncommon). LITTLE STRAWBERRY (uncommon). PLUM (13347). DETROIT (13592). WASHINGTON (*Fuller 1527*).

Epilobium angustifolium L., subsp. *circumvagum* Mosquin, fireweed. Occasional, fields. CANA (occasional). DETROIT (uncommon). WASHINGTON (*Fuller 1393*). ROCK (uncommon). LITTLE GULL (89-167).

E. ciliatum Raf., willow-herb. Occasional, wetlands. SNAKE (occasional). CHAMBERS (*Ugent 1196*). PLUM (14071). WASHINGTON (*Fewless & Moore 5927*). POVERTY (12817). SUMMER (*Tessene 85*).

E. coloratum Biehler, willow-herb. Uncommon, wetlands. CANA (rare). ROCK (12527).

E. leptophyllum Raf., marsh willow-herb. Rare, wetlands. WASHINGTON (*Schutz 54*, UWGB).

E. structum Spreng., downy willow-herb. SPECIAL CONCERN (WI). There is a 22 July 1926 Fuller collection (1447) from the fen on the north side of Little Lake, Washington Island. It was not seen in 1998.

Oenothera biennis L., common evening primrose. Occasional, fields and shores. WASHINGTON (*Fewless 5517*).

- O. oakesiana* (A. Gray) S. Watson & Coult., Oakes' evening-primrose. The common evening-primrose of dunes and shores. SNAKE (rare). GREEN (occasional). CANA (uncommon). CHAMBERS (13768). ADVENTURE (uncommon). LITTLE STRAWBERRY (uncommon). PLUM (13282). DETROIT (uncommon). PILOT (uncommon). WASHINGTON (Fuller 1411). ST. MARTIN (90-581). GRAVELLY (Cranbrook Institute-Oakland University sight record). LITTLE GULL (Cranbrook Institute-Oakland University sight record). SUMMER (Tessene 19). LITTLE SUMMER (occasional).
- O. parviflora* L., small-flowered evening primrose. Occasional. CHAMBERS (Ugent 1198). ROCK (Cochrane 5196).

OROBANCHACEAE (Broom-Rape Family)

- Conopholis americana* (L.) Wallr., Squawroot. Rare, woods. A parasite on oak roots. WASHINGTON (Boyer Bluff, Tans 256, WIS; Schutz 107, UWGB).
- Epifagus virginiana* (L.) W.P.C. Barton, beech-drops. Occasional parasite on the roots of beech trees. CHAMBERS (Ugent 1116). DETROIT (13873). WASHINGTON (Schuette 38638, 23 Sept. 1889, WIS; Schutz 132, UWGB). ROCK (13837).
- Orobanche uniflora* L., cancer-root. SPECIAL CONCERN (WI). Locally common in white cedar forest on dolomite clifftops on Plum Island (Tans 800) in 1998; reported from Detroit Island (Huntton 1977); rare in similar habitats on Washington (as at Percy Johnson County Park, Cochrane 11099), Rock (several sight records by Cochrane or Tans), and Poverty Islands (89-236).

ORCHIDACEAE (Orchid Family)

- Calopogon tuberosus* (L.) Britton, Sterns & Poggenb., grass pink. Known only from the boreal fen at the north end of Little Lake, Washington Island (Fuller 1439).
- Calypso bulbosa* (L.) Oakes, calypso orchid. THREATENED (WI and MI). There were several records for Washington Island in the 1920's and 1930's (Fuller 1666), with Fuller (1927) calling it "abundant on various parts of the island"; in another paper he notes that this orchid was was so common that it was used to decorate graves on Memorial Day! It was not seen in the present survey and there have been no sightings for several decades. Possibly deer herbivory is responsible for its decline. There is also a 1926 Fuller record from St. Martin Island, Michigan.
- Coeloglossum viride* (L.) Hartm., long-bracted green orchid. Uncommon, upland woods. WASHINGTON (Fuller 3670). ROCK (13216). ST. MARTIN (old village site, 90-543).
- Corallorhiza maculata* (Raf.) Raf., spotted coralroot. Occasional, woods. CHAMBERS (Ugent 1057). WASHINGTON (mapped in atlas of Wisconsin plants). POVERTY (90-239). SUMMER (Tessene 51).
- C. striata* Lindl., striped coralroot. Occasional, mostly cool coniferous woods. WASHINGTON (3663). ROCK (13179). POVERTY (89-239). SUMMER (Hagenah et al., 6911, BLH). LITTLE SUMMER (12940).
- C. trifida* Chatel., early coralroot. Occasional, woods, often in cedar swamps. WASHINGTON (Fuller 3664). ST. MARTIN (90-554). SUMMER (Hagenah et al. 6701.5). LITTLE SUMMER (12916).
- Cypripedium parviflorum* Salisb., small yellow lady's-slipper. SPECIAL CONCERN (MI), no status (MI). This conifer swamp species is known from a 1931 collection from Washington Island, probably from Jackson Harbor Ridges (Fuller 3662). There is also a historical collection from St. Martin Island, Michigan. It was not relocated in 1998-1999, although its larger cousin *C. pubescens* is thriving on many parts of Washington Island.
- C. pubescens* Willd., large yellow lady's-slipper. Occasional to locally frequent in rich deciduous woods to conifer stands. PLUM (rare, 13397). DETROIT (occasional, 13532). WASHINGTON (fairly common, 13025). ROCK (uncommon, 13179). ST. MARTIN (near pond, 90-328).
- C. reginae* Walter, showy lady's-slipper. SPECIAL CONCERN (MI), no status (MI). This conifer swamp species is known from a 1926 collection from Washington Island, probably from Coffee Swamp (Fuller 1543). There is also a 1989 collection from St. Martin Island, Michigan (89-049). It was not relocated in 1998-1999 and may be declining because of deer herbivory.

- **Epipactis helleborine* (L.) Crantz, helleborine orchid. Becoming a common weed in woods. CHAMBERS (13740). PLUM (13306). DETROIT (13508). WASHINGTON (Fuller 13619). ROCK (12508). LITTLE SUMMER (12980).
- Goodyera oblongifolia* Raf., green-leaved rattlesnake-plantain. Rare, woods. SUMMER (12857).
- G. repens* (L.) R. Br. var. *ophioides* Fernald, creeping rattlesnake-plantain. Uncommon, coniferous woods. WASHINGTON (uncommon, Jackson Harbor Ridges). ROCK (12635).
- G. tessellata* Lodd., checkered rattlesnake-plantain. Uncommon, woods. WASHINGTON (13807). ST. MARTIN (near cliff faces, 90-514).
- Liparis loeselii* (L.) Rich., green twayblade. Reported by Fuller (1927) from Washington Island.
- Malaxis monophyllos* (L.) Sw. var. *brachypoda* (A. Gray) F.J.A. Morris & Eames, white adder's-mouth. SPECIAL CONCERN (WI). Rare, one plant noted on 8 July 1998 in a cedar swamp in the Big Marsh area of Washington Island.
- Platanthera dilatata* (Pursh) Beck, white bog orchid. SPECIAL CONCERN (WI). Known in the GTA only from a 1926 collection from somewhere on Washington Island (Fuller 1463). This is a species of fens and open minerotrophic conifer swamps, and most likely was found at Little Lake fen or in Coffee Swamp. It was not relocated in 1998.
- P. hookeri* (A. Gray) Lindl., Hooker's orchid. Rare, Washington Island, a 9 June 1927 photograph by Fuller at MIL.
- P. hyperborea* (L.) Lindl. var. *huronensis* (Nutt.) Luer, tall northern green orchid. Occasional in moist woods and swamps. DETROIT (uncommon). WASHINGTON (Goessl 3970). ROCK (Cochrane 89-117). ST. MARTIN (four collections; 89-117). SUMMER (Freckmann 13206).
- P. obtusata* (Pursh) Lindl., blunt-leaved orchid. Rare, Summer Island (cedar swamp, 12852).
- P. orbiculata* (Pursh) Lindl., large round-leaved orchid. SPECIAL CONCERN (WI). There is a 1975 sight record by Bill Tans from hardwoods near Coffee Swamp, Washington Island, and also a 1968 Summer Island, Michigan collection (Tessene 76). This orchid of cool woods was not relocated in 1998-1999.
- P. psycodes* (L.) Lindl., purple fringed orchid. Rare, Summer Island in 1969 (Bourdo 22566, MSC).
- Pogonia pogoniosoides* (L.) Ker Gawl., rose pogonia. Known only from the boreal fen at the north end of Little Lake, Washington Island (Fuller 1440).
- Spiranthes cernua* (L.) Rich., nodding lady's-tresses. Uncommon, wet areas. WASHINGTON (Jackson Harbor Ridges, Fewless & Moore 5945). ROCK (G.J. Knudson sight record, Sept. 1964).
- S. romanzoffiana* Cham., hooded lady's-tresses. Uncommon, wet areas. WASHINGTON (Threlfall s.n., UWGB).

OXALIDACEAE (Wood-Sorrel Family)

- O. stricta* L., common yellow oxalis. Frequent weedy species. CANA (uncommon). CHAMBERS (13765). DETROIT (uncommon). WASHINGTON (13784). ROCK (12526). ST. MARTIN (90-569).

PAPAVERACEAE (Poppy Family)

- **Papaver rhoeas* L., corn poppy. Weed in gravelly lane, Little Summer Island (12964).
- Sanguinaria canadensis* L., bloodroot. Fairly common, rich woods. CHAMBERS (Ugent 1031). DETROIT (occasional). WASHINGTON (Fuller 1463). ROCK (12608). ST. MARTIN (90-560). LITTLE SUMMER (rare).

PLANTAGINACEAE (Plantain Family)

- **Plantago lanceolata* L., English plantain. Occasional weed. CHAMBERS (13763). DETROIT (13439). WASHINGTON (13018). ROCK (12539).
- **P. major* L., common plantain. Common weed. SNAKE (uncommon). CANA (occasional). CHAMBERS (Ugent 1117). HORSESHOE (rare). DETROIT (occasional). WASHINGTON (Fuller 1510). ROCK (13817). SUMMER (Freckmann 13207). LITTLE SUMMER (uncommon).
- P. rugelii* Decne., Rugel's plantain. Rare. WASHINGTON (Schutz 131, UWGB).

POACEAE (Grass Family)

- **Agrostis gigantea* Roth, redtop. Occasional weed. CHAMBERS (*Ugent 1092*). SUMMER (*Long s.n.*, 27 July 1974, UWSP).
- A. hyemalis* (Walter) Britton, Sterns & Poggenb. var. *scabra* (Willd.) Blomq., ticklegrass. Occasional, dunes and dry dolomite ledges. SNAKE (occasional). CANA (uncommon). PLUM (14062). DETROIT (13431). WASHINGTON (*Fewless 5536*). SUMMER (*Tessene 170*).
- **A. stolonifera* L. var. *palustris* (Huds.) Farw., creeping bent grass. Occasional, shores. CANA (occasional). DETROIT (13453). WASHINGTON (*Fewless 5481*). ROCK (13641).
- Alopecurus aequalis* Sobol., short-awned foxtail. Rare, near pond and dump on St. Martin Island (90-307).
- Ammophila breviligulata* Fernald, beach grass. Fig. 6. Locally abundant on dunes. CHAMBERS (Sand Point, north bay, and south tip of island, *Ugent 1078*). WASHINGTON (Jackson Harbor, Dunes Park, Percy Johnson County Park, *Fewless 5494*). ROCK (13679). SUMMER (Summer Harbor, *Voss 13385*).
- Andropogon gerardii* Vitman, big bluestem. Locally common, Great Lakes pine barrens on Chambers Island (*Ugent 1078*).
- Bromus ciliatus* L., fringed brome. Occasional, woods and wet alkaline rockshores. DETROIT (13874). ST. MARTIN (old village site, 90-522).
- **B. inermis* Leyss., smooth brome. Occasional to frequent weed. CHAMBERS (13726). WASHINGTON (*Fewless 5544*). ROCK (13115). POVERTY (*Cranbrook Institute-Oakland University sight record*).
- B. kalmii* A. Gray, Kalm's brome. Occasional, woods and wet alkaline rockshores. SNAKE (uncommon). WASHINGTON (13804). SUMMER (*Freckmann 13149*).
- **B. tectorum* L. var. *glabratus* Spenn., cheat grass. Locally common weed on dunes. GREEN (common, 13254). ROCK (*Cochrane 5199*).
- Calamagrostis canadensis* (Michx.) P. Beauv., Canada bluejoint. Common wetland grass. CANA (occasional). CHAMBERS (*Ugent 1084*). PLUM (13373). DETROIT (13516). WASHINGTON (*Fewless 5563*). SUMMER (occasional). LITTLE SUMMER (occasional).
- C. stricta* (Timm) Koeler subsp. *inexpansa* (A. Gray) C.W. Greene, slim-stemmed reed grass. SPECIAL CONCERN (WI), as just *Calamagrostis stricta*. This species is known from several populations on Great Lakes alkaline rockshores on Washington (*Fewless & Moore 5480*), Plum (14094), Poverty (89-207) and Summer Islands (*Tessene 161*). It was also found in a marly bulrush wetland at Big Marsh on Washington Island.
- Cinna latifolia* (Gopp.) Griseb., drooping wood-reed. Uncommon, rich woods. CHAMBERS (13953). DETROIT (occasional). WASHINGTON (13700). ROCK (13836).
- **Dactylis glomerata* L., orchard grass. Fairly common weed of old fields and pastures. CANA (common). CHAMBERS (13773). SPIDER (1905 collection, MIL). PLUM (13335). DETROIT (occasional). WASHINGTON (*Fuller 1497*). ROCK (13146). LITTLE SUMMER (12998).
- Danthonia spicata* (L.) Roem. & Schult., poverty oat grass. Occasional, dunes and dry coniferous dune forests. WASHINGTON (*Fewless 5541*). ROCK (uncommon). SUMMER (*Freckmann 13203*).
- Deschampsia cespitosa* (L.) P. Beauv., tufted hair grass. SPECIAL CONCERN (WI). Locally abundant on Great Lakes alkaline rockshore and alvar on Detroit Island (south end, 13589, *Alverson 1252*, WIS), Washington Island (southeast coast and Jackson Harbor, *Fewless 5209*), Cana Island (uncommon), and Poverty (90-275) and Summer (*Tessene 73*) Islands, Michigan. Known from an historical site on Spider Island (1905 collection, MIL).
- D. flexuosa* (L.) Trin., wavy hair grass. SPECIAL CONCERN (WI). Local on stabilized wooded dunes with pine and oak on Chambers Island (near Mud Lake, 13739) and Rock Island (near the south coast, 13655).
- **Digitaria ischaemum* (Schweigg.) Muhl., common crabgrass. Uncommon weed, mostly on sandy roadsides. CHAMBERS (13992). WASHINGTON (13779).
- Elymus canadensis* L., Canada wild-rye. Locally common, dunes or shoreline gravel. SNAKE (occasional). CANA (uncommon). CHAMBERS (*Ugent 1081*). PLUM (14085).

- DETROIT (13894). WASHINGTON (*Schutz* 59, UWGB). HOG (rare). ROCK (*Cochrane* 5197). SUMMER (*Tessene* 139). LITTLE SUMMER (uncommon).
- E. hystrix* L., bottlebrush grass. Uncommon, rich upland deciduous woods. WASHINGTON (13702). ROCK (*Cochrane* 5226).
- E. trachycaulus* (Link) Shinn., slender wheat grass. Fairly common, dunes and shores. GREEN (13196). CHAMBERS (*Ugent* 1085). PLUM (occasional). DETROIT (13455, 13866). WASHINGTON (*Fewless* 5492). ROCK (*Cochrane* 5218). ST. MARTIN (90-326). SUMMER (*Tessene* 166). LITTLE SUMMER (*Freckmann* 13145).
- E. villosus* Willd., hairy wild-rye. Rare, rich upland beech-maple woods on Rock Island (12599).
- E. virginicus* L., Virginia wild-rye. Rare, Little Summer Island (*Freckmann* 13146).
- Elytrigia dasystachya* (Hook.) A. Löve & D. Löve subsp. *psammophila* (J.M. Gillett & Senn) Dewey, thickspike wheatgrass. THREATENED (WI), as *Elymus lanceolatus* subsp. *psammophilus*. This dune grass is found (1998) on Washington Island (Dunes Park; *Davis s.n.*, 2 July 1931, WIS and *Cochrane* 11088) and Rock Island (south beach, 13680). In both places it is threatened by heavy foot traffic.
- **E. repens* (L.) B.D. Jacks., quack grass. Common weed. CHAMBERS (*Ugent* 1083). PLUM (14092). DETROIT (fairly common). WASHINGTON (*Fuller* 1367). ROCK (*Cochrane* 5193). POVERTY (90-217). SUMMER (12896).
- Festuca occidentalis* Hook., western fescue. THREATENED (WI). There are old to recent records from Plum (*Voice et al.* 82004, MSC), Washington ("not common", *Goessl* 3968) and Summer Islands (interior of island, 90-748; local along trail through cedar-fir woods near shore in Sec. 27, *Voss* 13391). It was not relocated from any of these islands in 1998-1999.
- **F. pratensis* Huds., meadow fescue. Occasional weed of fields and roadsides. PLUM (13298). DETROIT (13517). WASHINGTON (*Fewless* 5543). ROCK (13666). ST. MARTIN (interior, 90-576). SUMMER (12887).
- **F. rubra* L., red fescue. Locally common weed. CANA (common in lawn). CHAMBERS (12702). WASHINGTON (1971 sight record by *Cochrane*). ROCK (common in lawn by Viking Hall, 12648). POVERTY (12811). SUMMER (12908). LITTLE SUMMER (13004).
- F. saximontana* Rydb., Rocky Mountain fescue. Occasional, dunes. CHAMBERS (13754). WASHINGTON (Jackson Harbor Ridges, *Cochrane* 5264). ROCK (13109).
- F. subverticillata* (Pers.) E.B. Alexeev, nodding fescue. Occasional, rich upland hardwoods. PLUM (13350). DETROIT (13577). WASHINGTON (13703). ROCK (*Cochrane* 5203). LITTLE SUMMER (12960).
- **F. trachyphylla* (Hack.) Krajina, sheep fescue. Occasional. PLUM (13424). WASHINGTON (*Fewless* 5216). ROCK (12109).
- Glyceria borealis* (Nash) Batch., northern manna grass. Fig. 9. Uncommon, wetlands. WASHINGTON (Big Marsh, 13708). SUMMER (*Freckmann* 13205).
- G. striata* (Lam.) Hitchc., fowl manna grass. Fairly common, wetlands. CHAMBERS (13971). DETROIT (13480). WASHINGTON (*Goessl* 3937). ROCK (13670). SUMMER (*Tessene* 126). LITTLE SUMMER (12919).
- Hierochloa hirta* (Schränk) Borbas subsp. *arctica* (J. Presl) G. Weim., sweet grass. Uncommon, moist sandy areas. CHAMBERS (*Ugent* 1082). DETROIT (12780). WASHINGTON (*Goessl* 3931).
- Hordeum jubatum* L., foxtail barley. Rare exotic. SNAKE (rare).
- Leersia oryzoides* (L.) Sw., rice cut grass. Uncommon, wetlands. SNAKE (fairly common). CHAMBERS (13916). WASHINGTON (13778).
- **Lolium perenne* L., rye grass. Rare weed. WASHINGTON (13187, *Goessl* 3951).
- Milium effusum* L., wood millet. Occasional to common in rich upland hardwoods; appears to increase under deer herbivory; perhaps not a preferred browse. PLUM (13329). DETROIT (13505). WASHINGTON (13046). ROCK (*Cochrane* 5210). ST. MARTIN (90-547). LITTLE SUMMER (12947).
- Muhlenbergia glomerata* (Willd.) Trin., marsh timothy. Rare, only in boreal fen at Coffee Swamp, Washington Island (13802).

- M. mexicana* (L.) Trin., Mexican muhly. Uncommon, moist edges. CHAMBERS (*Ugent 1091*). DETROIT (13848).
- Oryzopsis asperifolia* Michx., rough-leaved rice grass. Fairly common, mostly in cedar-fir thickets and dune forests. CHAMBERS (*Ugent 1088*). DETROIT (occasional). WASHINGTON (*Fewless 5158*). ROCK (12641). SUMMER (12850).
- O. pungens* (Spreng.) Hitchc., mountain rice grass. Rare, dune forests at Jackson Harbor Ridges, Washington Island (*Fewless 5215*).
- O. racemosa* (Sm.) Hitchc., black-seeded rice grass. Occasional, rich upland hardwoods, often where dolomite is near or at the surface; not on the Michigan Islands. CHAMBERS (*Ugent 1086*). DETROIT (rare). WASHINGTON (13625). ROCK (12512).
- Panicum acuminatum* Sw., western panic grass. Includes both vars. *fasciculatum* (Torr.) Lelong and var. *lindheimeri* (Nash) Lelong. Fairly common, old fields, ditches, and alkaline rockshores. PLUM (14082). DETROIT (13652). WASHINGTON (*Fewless 5484*). ROCK (13640). SUMMER (*Tessene 117*). LITTLE SUMMER (12923).
- P. capillare* L., witch grass. Occasional in weedy disturbed ground, cultivated fields. SNAKE (uncommon). CHAMBERS (13959). PLUM (14075). WASHINGTON (*Fewless & Moore 5913*). ST. MARTIN (*Fuller 1627*). SUMMER (*Freckmann 13202*).
- P. columbianum* Scribn., hemlock panic grass. Rare, only from Summer Harbor, Summer Island (*Freckmann 13191*).
- P. latifolium* L., broad-leaved panic grass. Rare, only from a red oak stand near Sand Point on Chambers Island (13922).
- **Phalaris arundinacea* L., reed canary grass. Common wetland weed. SNAKE (fairly common). CANA (rare). CHAMBERS (13723). HORSESHOE (uncommon). PLUM (14077). DETROIT (13558). WASHINGTON (*Fuller 1556*). ROCK (13669). POVERTY (90-265). SUMMER (*Tessene 141*). LITTLE SUMMER (uncommon).
- **Phleum pratense* L., timothy. Common weed of old fields. CHAMBERS (*Ugent 10679*). PLUM (13367). DETROIT (13581). WASHINGTON (*Fewless 5542*). ROCK (*Cochrane 5178*). ST. MARTIN (89-032). POVERTY (90-236). SUMMER (*Tessene 145*). LITTLE SUMMER (occasional).
- Phragmites australis* (Cav.) Steud., giant reed. Fig. 8. Occasional wetland grass; sometimes washing up on beaches and persisting, as on Rock Island from 1997-1999. CHAMBERS (*Ugent 1080*). DETROIT (rare, north bay). WASHINGTON (13061). ROCK (13829). SUMMER (12864).
- **Poa annua* L., annual bluegrass. Common weed, often along trails; also on bird islands. SNAKE (occasional). CANA (occasional). CHAMBERS (12743). DETROIT (13493). PILOT (occasional). WASHINGTON (12652). ROCK (12552). ST. MARTIN (90-572). POVERTY (uncommon). SUMMER (12848).
- **P. compressa* L., Canada bluegrass. Common, dry old fields, pastures, and dunes. SNAKE (occasional). GREEN (13244). CANA (common). CHAMBERS (*Ugent 1089*). SPIDER (1905 collection, MIL). PLUM (13359). DETROIT (fairly common, north tip field). PILOT (occasional). WASHINGTON (*Fewless 5921*). ROCK (13654). ST. MARTIN (90-501). GULL (90-610). POVERTY (occasional). SUMMER (*Freckmann 13138*). LITTLE SUMMER (occasional).
- **P. nemoralis* L., wood bluegrass. Occasional in dry places, dolomite rockshore crevices. CHAMBERS (*Ugent 1090*). ST. MARTIN (90-511). SUMMER (*Voss 13373a*).
- P. palustris* L., fowl meadow grass. Fairly common, wetlands and bird islands. SNAKE (occasional). GREEN (13191). CANA (uncommon). HAT (rare). ADVENTURE (*Bruncken s.n.*, 11 June 1897, WIS). JACK (rare). SPIDER (1905 collection, MIL). PLUM (13366). PILOT (uncommon). WASHINGTON (occasional). ST. MARTIN (89-098). POVERTY (12831). SUMMER (*Freckmann 13199*).
- **P. pratensis* L., Kentucky bluegrass. Common lawn and field grass. SNAKE (occasional). GREEN (13195). CANA (abundant). ADVENTURE (occasional). HORSESHOE (occasional). SPIDER (*Fewless 3175*). DETROIT (13580). WASHINGTON (*Fewless 5545*). ROCK (*Cochrane 5204*). ST. MARTIN (89-100). GULL (89-181). POVERTY (90-234). SUMMER (12882). LITTLE SUMMER (occasional).
- Poa saltuensis* Fernald & Wiegand, woodland bluegrass. Uncommon, rich upland hardwood forests. WASHINGTON (Boyer Bluff, *Cochrane 11050*; hardwoods near Coffee Swamp,

- 13050; hardwoods near Little Marsh, 14012). SUMMER (interior trail through hardwoods, 90-704).
- Schizachne purpurascens* (Torr.) Swallen, false melic grass. Occasional in moist deciduous to dry coniferous forests. CHAMBERS (12747). DETROIT (13550). WASHINGTON (Cochrane 11077). ROCK (12514).
- Schizachyrium scoparium* (Michx.) Nash, little bluestem. Locally common on dunes and barrens. CHAMBERS (13903). WASHINGTON (Jackson Harbor Ridges, Schutz 141, UWGB).
- **Setaria viridis* (L.) P. Beauv., green foxtail. Occasional weed. CHAMBERS (13941). WASHINGTON (13782).
- Sorghastrum nutans* (L.) Nash, Indian grass. Locally common in Great Lakes pine barrens at Sand Point and north bay, Chambers Island (13899).
- Sphenopholis intermedia* (Rydb.) Rydb., slender wedge grass. Occasional, gravelly to dolomitic alkaline shores. SNAKE (uncommon). PLUM (Carp Lake, 14081). WASHINGTON (Fewless 5535). POVERTY (90-261). SUMMER (Tessene 64, Freckmann 13197).
- Sporobolus cryptandrus* (Torr.) A. Gray, sand dropseed. Occasional, dunes and pine barrens. CHAMBERS (13912). WASHINGTON (Jackson Harbor Ridges, Fewless & Moore 5929).
- Stipa spartea* Trin., needle grass. Locally common on Great Lakes pine barrens at Sand Point and north bay on Chambers Island (13759).
- Trisetum melicoides* (Michx.) Scribn., purple false oats. ENDANGERED (WI), no status (MI). This rare eastern grass is usually found in cold coniferous or mixed woods. There are no records for the Wisconsin islands, but there are 1968 (Sec. 34, Tessene 169) and 1976 (Freckmann 13198) collections from Summer Island, Michigan. It was not relocated in 1998.

POLEMONIACEAE (Phlox Family)

- Phlox divaricata* L. subsp. *laphamii* (A.W. Wood) Wherry, blue phlox. Known only from St. Martin Island (89-126, 90-598). Slightly disjunct from farther south.

POLYGALACEAE (Milkwort Family)

- Polygala paucifolia* Willd., fringed polygala. Locally common in moist cedar-fir thickets and coniferous dune forests. CHAMBERS (Ugent 1207). PLUM (13380). DETROIT (12786). WASHINGTON (Fuller 1577). ST. MARTIN (89-140). POVERTY (12808). SUMMER (Voss 12627).
- P. senega* L., Seneca snakeroot. Uncommon, alvars, Great Lakes alkaline rockshores, and pine barrens. CHAMBERS (13758). DETROIT (13571). WASHINGTON (T34N-R30E, Sec. 28, Threlfall s.n., UWGB). POVERTY (89-190). SUMMER (Tessene 5).

POLYGONACEAE (Smartweed Family)

- Polygonum achoreum* S.F. Blake, leathery knotweed. Rare weed. CHAMBERS (13940).
- P. amphibium* L., water smartweed. Frequent, ponds and marshes. CANA (rare). CHAMBERS (13928). PLUM (uncommon, Carp Lake). WASHINGTON (Goessl 3966). ST. MARTIN (pond, 90-313). SUMMER (swamp, Tessene 95).
- **P. aviculare* L., common knotweed. Occasional roadside and dooryard weed. CANA (uncommon). CHAMBERS (13939). WASHINGTON (Fuller 1530). SUMMER (Freckmann sight record, 1976).
- P. cilinode* Michx., fringed bindweed. Common weedy species, often on bird islands. GREEN (13226). ADVENTURE (Bruncken s.n., 11 July 1905). PLUM (13351). DETROIT (13506). HOG (occasional). ROCK (Cochrane 5205). LITTLE GULL (89-166). GULL (Cranbrook Institute-Oakland University sight record).
- P. convolvulus* L., black bindweed. Occasional weedy species. CHAMBERS (Ugent 1007). DETROIT (13886). GRAVELLY (Taylor s.n., 1978, MSC). SUMMER (Freckmann 13209).
- P. erectum* L., erect knotweed. Rare weedy species on Spider Island (Fewless 3172).
- P. lapathifolium* L., curly-top knotweed. Occasional, moist areas. CHAMBERS (Ugent 1005). PILOT (uncommon). HOG (Fuller 1511). SUMMER (Tessene 31).
- **P. orientale* L., prince's-feather. Rare escape from cultivation in 1926. WASHINGTON (Fuller 1551).

- P. pennsylvanicum* L., Pennsylvania knotweed. Rare weedy species. SNAKE (locally common). CHAMBERS (*Ugent* 1012).
- P. persicaria* L., lady's-thumb. Occasional weedy species. CANA (uncommon). CHAMBERS (*Ugent* 1011). DETROIT (13861). WASHINGTON (13786).
- P. punctatum* L., dotted smartweed. Uncommon, wetlands. SNAKE (common). CHAMBERS (13956). SUMMER (*Tessene* 34).
- P. ramosissimum* Michx., bushy knotweed. Uncommon, dunes and shores. CHAMBERS (*Ugent* 1004). DETROIT (13864). WASHINGTON (*Fewless & Moore* 5947).
- P. scandens* L., climbing false buckwheat. Rare. WASHINGTON (*Threlfall s.n.*, UWGB).
- Rumex acetosella* L., sheep sorrel. Common weed of sandy and gravelly old fields and dunes. GREEN (13253). CHAMBERS (*Ugent* 1013). PLUM (13337). WASHINGTON (13715). ROCK (13660). SUMMER (*Long s.n.*, 27 July 1974, UWSP).
- **R. crispus* L., curly dock. Fairly common weed. CHAMBERS (13766). HORSESHOE (rare). PLUM (13396). DETROIT (13440). WASHINGTON (*Fuller* 1514). HOG (occasional). ROCK (rare). GRAVELLY (*Cranbrook Institute-Oakland University sight record*). GULL (89-170). SUMMER (*Tessene* 44).
- **R. obtusifolius* L., bitter dock. Uncommon weed. CANA (rare). WASHINGTON (13706).
- R. orbiculatus* A. Gray, great water dock. Uncommon in swamps and marshes. DETROIT (13470). PLUM (rare). SUMMER (vernal woodland pond, rare).
- R. salicifolius* Weinm. var. *mexicanus* (Meisn.) C.L. Hitchc., willow dock. This is *Rumex triangulivalvis* (Danser) Rech. Of Voss (1984). Known only from Gravelly Island (89-144, 90-617).

PORTULACACEAE (Purslane Family)

- Claytonia caroliniana* Michx., Carolina spring-beauty. Locally common in rich upland hardwood forests. PLUM (12686). DETROIT (12665). WASHINGTON (12656). ROCK (12603). SUMMER (rare). LITTLE SUMMER (12955).
- **Portulaca oleracea* L., purslane. Uncommon garden weed. WASHINGTON (13785). LITTLE GULL (89-168). SUMMER (*Voss* 12639).

POTAMOGETONACEAE (Pondweed Family)

- **Potamogeton crispus* L., curly pondweed. Occasional in Lake Michigan. WASHINGTON (*Fewless* 5573). ROCK (13671). SUMMER (Sec. 22, *Tessene* 175-177).
- P. gramineus* L., grass-leaved pondweed. Uncommon aquatic. SUMMER (*Freckmann* 13182).
- P. illinoensis* Morong, Illinois pondweed. Mackaysee Lake, Chambers Island (13978.5).
- P. natans* L., common pondweed. Occasional aquatic of ponds and lakes. CHAMBERS (Lake Mackaysee, occasional). WASHINGTON (occasional).
- P. praelongus* Wulfen, white-stemmed pondweed. Mackaysee Lake, Chambers Island (13978).
- Stuckenia filiformis* (Pers.) Borner, thread-leaved pondweed. Occasional aquatic. WASHINGTON (*Fewless* 5572). SUMMER (*Freckmann* 13181).

PRIMULACEAE (Primrose Family)

- Lysimachia ciliata* L., fringed loosestrife. Uncommon, wetlands. WASHINGTON (*Threlfall s.n.*, UWGB). POVERTY (89-265).
- **L. nummularia* L., moneywort. Rare weed. WASHINGTON (*Threlfall s.n.*, UWGB).
- L. quadriflora* Sims, narrow-leaved loosestrife. Occasional, wet alkaline marshes and rock-shores. PLUM (14079). DETROIT (13863). WASHINGTON (Fiegenscaus Harbor, southeast coast rockshore, Jackson Harbor Ridges, Big Marsh, West Harbor; *Fuller* 1488). SUMMER (*Tessene* 90).
- L. terrestris* (L.) Britton, Sterns & Poggenb., swamp candles. Uncommon, swamps. WASHINGTON (*Fuller* 1452).
- L. thyrsiflora* L., swamp loosestrife. Fairly common, swamps and marshes. CANA (rare). CHAMBERS (*Ugent* 1204). PLUM (9 July 1905 collection, MIL). DETROIT (13482). WASHINGTON (13055). POVERTY (12820). SUMMER (*Voss* 13371).
- Primula mistassinica* Michx., bird's-eye primrose. Fig. 54. SPECIAL CONCERN (WI). Bird's-eye primrose is one of the most characteristic species of Great Lakes alkaline rock-



FIGURE 54. Members of the Botanical Club of Wisconsin admiring a "fairy ring" of bird's-eye primrose (*Primula mistassinica*) growing in a mown lawn at Jackson Harbor Ridges, Washington Island, Wisconsin. Note Theodore S. Cochrane (at rear in wide-brimmed hat) and Robert W. Freckmann (in white coat with camera below and to the right of Ted), two important Grand Traverse Islands collectors, 15 May 1999.

shore, forested ridge and swale, and alvar communities. It was locally common on Detroit (south end, 12660, *Alverson* 1258, WIS) and Washington (southeast coast and Jackson Harbor Ridges, *Goessl* 3991) Islands in Wisconsin, and on Poverty (89-286) and Summer Islands (*Voss* 13371) in Michigan. It is also reported from St. Martin Island, Michigan by Fuller (1927), and there were a few plants on Cana Island in 1998.

Trientalis borealis Raf., starflower. Common, woods. CHAMBERS (*Ugent* 1205). PLUM (occasional). DETROIT (13540). WASHINGTON (*Fuller* 1422). ROCK (*Cochrane* 5183). ST. MARTIN (89-074). GULL (*Cranbrook Institute-Oakland University sight record*). POVERTY (common). SUMMER (*Voss* 12650). LITTLE SUMMER (abundant).

PYROLACEAE (Shinleaf Family)

Chimaphila umbellata (L.) W.P.C. Barton subsp. *cisatlantica* (S.F. Blake) Hultén, pipsissewa. Uncommon, mostly in dryish coniferous woods. WASHINGTON (*Fuller* 1490). ROCK (12632). ST. MARTIN (90-513).

Moneses uniflora (L.) A. Gray, one-flowered wood-nymph. Uncommon in cool coniferous woods. POVERTY (90-204). SUMMER (*Tessene* 107).

Orthilia secunda (L.) House, one-sided shinleaf. Uncommon in coniferous woods, including cedar swamps. CHAMBERS (13731). WASHINGTON (*Fuller* 1424). ST. MARTIN (89-079). POVERTY (89-215). SUMMER (12856).

Pyrola asarifolia Michx., pink shinleaf. Uncommon, mostly in cool coniferous woods. PLUM (9 July 1905 collection, MIL). WASHINGTON (13074). SUMMER (12889).

P. chlorantha Sw., green-flowered wintergreen. Uncommon, coniferous woods, often in cedar-fir thickets. CHAMBERS (uncommon, pine forest on north bay). SPIDER (1905 collection, MIL). WASHINGTON (13616). POVERTY (*Cranbrook Institute-Oakland University sight record*). SUMMER (*Tessene* 168).

P. elliptica Nutt., large-leaved shinleaf. Fairly common, woods. CHAMBERS (13732). DETROIT (13541). WASHINGTON (Fuller 1554). ROCK (Cochrane 5217). POVERTY (89-238). SUMMER (Cranbrook Institute-Oakland University sight record).

RANUNCULACEAE (Buttercup Family)

- Actaea pachypoda* Elliott, white baneberry. Fairly common, woods. CHAMBERS (13735). PLUM (13418). DETROIT (13535). WASHINGTON (Fuller 1461). ROCK (Threlfall s.n., UWGB). ST. MARTIN (89-119). POVERTY (90-244). SUMMER (Tessene s.n.). LITTLE SUMMER (Freckmann 13150).
- A. rubra* (Aiton) Willd., red baneberry. Fairly common, woods, usually in cooler or more coniferous sites than the previous species. SNAKE (uncommon). GREEN (13224). CANA (rare). CHAMBERS (13736). LITTLE STRAWBERRY (rare). PLUM (13403). DETROIT (13495). WASHINGTON (Rose 319). ROCK (Cochrane 5208). ST. MARTIN (89-137). POVERTY (89-252). SUMMER (Tessene 41). LITTLE SUMMER (occasional).
- Anemone acutiloba* (DC.) G. Lawson, sharp-lobed hepatica. Fairly common, woods. CHAMBERS (Ugent 1028). PLUM (uncommon). DETROIT (rare). WASHINGTON (Goessl 3960). ROCK (12611). ST. MARTIN (90-538). SUMMER (Tessene 127).
- A. americana* (DC.) H. Hara, round-lobed hepatica. Fairly common, woods. CHAMBERS (12711). PLUM (12668). WASHINGTON (Fuller 1570). ROCK (12600). SUMMER (occasional).
- A. canadensis* L., Canada anemone. Fairly common, fields and moist meadows. GREEN (13208). CANA (uncommon). HORSESHOE (uncommon). SPIDER (1905 collection, MIL). PLUM (13383). DETROIT (13489). WASHINGTON (Fuller 1418). ROCK (13097). ST. MARTIN (89-130). POVERTY (89-262). SUMMER (Tessene 12).
- A. cylindrica* A. Gray, thimbleweed. Occasional weedy species. GREEN (13267). CHAMBERS (Ugent 1025). SUMMER (Tessene 134).
- A. quinquefolia* L., wood anemone. Occasional, moist upland woods. CHAMBERS (common; Ugent 1021). WASHINGTON (Rose 328, UWGB). ROCK (12645).
- A. virginiana* L., thimbleweed. Occasional, moist open areas, alkaline rockshores. PLUM (13358). DETROIT (13531). WASHINGTON (Fuller 1404). ROCK (13145). ST. MARTIN (90-580). SUMMER (Cranbrook Institute-Oakland University sight record). LITTLE SUMMER (13002).
- Aquilegia canadensis* L., columbine. Fairly common, old fields, dolomite ledges, and cedar-fir thickets. SNAKE (common). GREEN (13249). CHAMBERS (Ugent 1027). ADVENTURE (occasional). HORSESHOE (uncommon). SPIDER (1905 collection, MIL). PLUM (13368). DETROIT (13523). WASHINGTON (Fuller 1452). ROCK (Cochrane 5190). ST. MARTIN (89-024). LITTLE GULL (Cranbrook Institute-Oakland University sight record). GULL (Cranbrook Institute-Oakland University sight record). POVERTY (Cranbrook Institute-Oakland University sight record). SUMMER (Tessene 174). LITTLE SUMMER (12991).
- Caltha palustris* L., marsh-marigold. Occasional in wet ash and cedar swamps. SPIDER (1905 collection, MIL). DETROIT (local, black ash swamp). WASHINGTON (Rose 329, UWGB). SUMMER (Voss 12649).
- Clematis virginiana* L., virgin's-bower. Uncommon, thickets. GREEN (13228). WASHINGTON (13057).
- Coptis trifolia* (L.) Salisb., goldthread. Uncommon, cedar swamps. DETROIT (13467). WASHINGTON (Coffee Swamp, Fuller 1540). SUMMER (Voss 12651).
- Ranunculus abortivus* L., small-flowered buttercup. Common, woods, especially along trails and on tip-up mounds. SNAKE (common). CHAMBERS (Ugent 1020). PLUM (12689). DETROIT (13499). WASHINGTON (occasional). ROCK (Threlfall s.n., UWGB). ST. MARTIN (89-059). SUMMER (Voss 12652). LITTLE SUMMER (uncommon).
- **R. acris* L., common buttercup. Fairly common weed, often along trails in woods. PLUM (13322). DETROIT (13497). WASHINGTON (Fuller 1414). ROCK (13150). POVERTY (90-229). SUMMER (90-736). LITTLE SUMMER (occasional).
- R. aquatilis* L. var. *diffusus* With., white water crowfoot. Rare in shallow water. WASHINGTON (Jackson Harbor Ridges, Fewless & Moore 5574).

- R. flabellaris* Raf., yellow water buttercup. Rare in a puddle in a cedar swamp at Big Marsh, Washington Island (14008), and in a woodland pond on St. Martin Island (90-305).
- R. flammula* L., creeping spearwort. Rare, sandy shore, probably from Jackson Harbor. WASHINGTON (Fuller 1538).
- R. hispidus* Michx., bristly buttercup. Uncommon, wetlands. SNAKE (uncommon). CHAMBERS (rare). LITTLE SUMMER (12937).
- R. pensylvanicus* L.f., bristly buttercup. Rare, observed on Snake Island.
- R. recurvatus* Poir., hooked buttercup. Occasional, wetlands, often in cedar swamps. CHAMBERS (rare). PLUM (rare). WASHINGTON (Goessl 3949). ROCK (13124). SUMMER (Voss 12637). LITTLE SUMMER (12984).
- R. scleratus* L., cursed crowfoot. Uncommon weedy species of wet areas and fields. CHAMBERS (13915). DETROIT (13573, 13860). WASHINGTON (Davis s.n., 2 July 1931, WIS). SUMMER (90-695).
- Thalictrum dasycarpum* Fisch. & Ave-Lall., tall meadow-rue. Occasional, wetlands. SNAKE (occasional). CHAMBERS (13746). DETROIT (uncommon). SUMMER (Tessene 114).
- T. dioicum* L., early meadow-rue. Fairly common, wetlands and alkaline rockshores. CHAMBERS (Ugent 1023). HORSESHOE (uncommon). SPIDER (1905 collection, MIL). PLUM (13399). DETROIT (uncommon). WASHINGTON (Goessl 3927). ROCK (Cochrane 5189).

RHAMNACEAE (Buckthorn Family)

- Ceanothus americanus* L., New Jersey tea. Local, Great Lakes pine barrens on Chambers Island (13767, 13935).
- C. herbaceus* Raf., New Jersey tea. Local, Great Lakes pine barrens on Chambers Island (13989).
- Rhamnus alnifolia* (L.) L'Her., alder buckthorn. Fig. 26. Locally common shrub of swamps and boreal fens. DETROIT (local in inland swamp near south tip, 13588). WASHINGTON (Coffee Swamp, Big Marsh, Fuller 1552).
- **R. frangula* L., glossy buckthorn. A weedy shrub of wetlands, fortunately not yet common on the islands. SNAKE (uncommon). GREEN (13207). PLUM (13302). WASHINGTON (Coffee Swamp, 13065).

ROSACEAE (Rose Family)

- Agrimonia gryposepala* Wallr., smooth agrimony. Occasional, woods. Possibly more frequent now because of dispersal by deer. CHAMBERS (13733). PLUM (uncommon). DETROIT (13892). WASHINGTON (Fuller 1565). ROCK (12532).
- Amelanchier arborea* (F. Michx.) Fernald, downy junberry. Occasional, woods. SNAKE (uncommon). SUMMER (Voss 13381). LITTLE SUMMER (occasional).
- A. interior* Nielsen, inland junberry. Uncommon small tree, Chambers Island (12718).
- A. laevis* Wiegand, smooth serviceberry. Occasional small tree, especially near edges. WASHINGTON (Fuller 1452). ST. MARTIN (90-533). POVERTY (90-226). SUMMER (Voss 12619).
- A. sanguinea* (Pursh) DC., low shadblow. Fairly common small tree, rich upland woods and bird islands. GREEN (13269). CANA (occasional). CHAMBERS (Ugent 1247). ADVENTURE (uncommon). HORSESHOE (uncommon). PLUM (13327). DETROIT (12790). PILOT (fairly common). WASHINGTON (Goessl 3986). ROCK (Cochrane 6187). ST. MARTIN (90-324).
- Argentina anserina* (L.) Rydb., silverweed. Common and characteristic of wet alkaline shores (sand, gravel, or dolomite), both on the coast and in the interior. SNAKE (occasional). CANA (fairly common). CHAMBERS (13751). ADVENTURE (rare). HORSESHOE (rare). PLUM (13376). DETROIT (13547). PILOT (rare). WASHINGTON (Rose 280, UWGB). ROCK (13140). ST. MARTIN (89-091). GULL (Cranbrook Institute-Oakland University sight record). POVERTY (Cranbrook Institute-Oakland University sight record). SUMMER (Tessene s.n.). LITTLE SUMMER ISLAND (fairly common).
- Aronia melanocarpa* (Michx.) Elliott, chokeberry. Rare, acid swamps. DETROIT (13466). WASHINGTON (Coffee Swamp, 13071).

- Comarum palustre* L., marsh cinquefoil. Uncommon, marshes. PLUM (9 July 1905 collection, MIL). WASHINGTON (Fuller 1443).
- Crataegus chrysocarpa* Ashe, fireberry hawthorn. Occasional, old fields. DETROIT (north tip old field). WASHINGTON (Cochrane 11079, Kruschke 49-162). ROCK (uncommon).
- C. macracantha* Loudon, hawthorn. Rare. WASHINGTON (Kruschke 49-164).
- C. macrosperma* Ashe, large-fruited hawthorn. Rare. WASHINGTON (Kruschke 49-161).
- C. punctata* Jacq., dotted hawthorn. Rare. WASHINGTON (Kruschke 49-163).
- Fragaria vesca* L. subsp. *americana* (Porter) Staudt, hillside strawberry. Fairly common, dunes and shorelines. ADVENTURE (uncommon). HORSESHOE (uncommon). PLUM (13305). DETROIT (13582). WASHINGTON (Fuller 1421b). ST. MARTIN (89-096). GULL (Cranbrook Institute-Oakland University sight record). POVERTY (89-251). SUMMER (Voss 13397). LITTLE SUMMER (occasional).
- F. virginiana* Duchesne, wild strawberry. Common, fields, dunes, and shores. SNAKE (occasional). GREEN (13261). CANA (occasional). CHAMBERS (Ugent 1241). ADVENTURE (uncommon). SPIDER (1905 collection, MIL). PLUM (13290). DETROIT (fairly common). WASHINGTON (Fewless 5157). ROCK (12628). ST. MARTIN (89-089). POVERTY (occasional). SUMMER (Voss 13401). LITTLE SUMMER (occasional).
- Geum aleppicum* Jacq., yellow avens. Common, fields, dunes, wetlands, shores. CHAMBERS (13949). ADVENTURE (Bruncken s.n., 11 July 1905, MIL). PLUM (13365). DETROIT (uncommon). WASHINGTON (Fuller 1369). ST. MARTIN (90-525). POVERTY (90-218). SUMMER (Tessene 30). LITTLE SUMMER (Freckmann 13148).
- G. canadense* Jacq., white avens. Occasional in same habitats as the previous species. CANA (uncommon). LITTLE STRAWBERRY (uncommon). PLUM (13308). DETROIT (13507). WASHINGTON (Fuller 1599). ROCK (13684). SUMMER (Freckmann sight record, 1976).
- G. rivale* L., water avens. Rare, swamps. WASHINGTON (Goessl 3979). SUMMER (Long s.n., 27 July 1974, UWSP).
- **Malus pumila* L., apple. Long-persisting and sometimes spontaneous in old fields and woodlands. CHAMBERS (Ugent 1243). PLUM (local). DETROIT (local, north tip field). WASHINGTON (Rose 4, UWGB). ST. MARTIN (90-563). POVERTY (89-246). SUMMER (Freckmann 13215).
- Pentaphylloides floribunda* (Pursh) A. Löve, shrubby cinquefoil or McDonald's bush. A characteristic species of alkaline rockshores. WASHINGTON (Rose 297, UWGB). POVERTY (89-216). SUMMER (Bourdo 20053, MSC).
- Physocarpus opulifolius* (L.) Maxim., ninebark. Fig. 10. Common, gravelly to dolomitic shores. SNAKE (occasional). CANA (common). CHAMBERS (rare). ADVENTURE (Bruncken s.n., 11 July 1897, MIL). PLUM (Tans 797). DETROIT (13432). PILOT (occasional). WASHINGTON (Rose 56, UWGB). HOG (fairly common). POVERTY (89-195). SUMMER (Tessene 20). LITTLE SUMMER (fairly common).
- **Potentilla argentea* L., silvery cinquefoil. Occasional weed in gravelly soil. CHAMBERS (13983). WASHINGTON (13181). ROCK (13826, 13637). ST. MARTIN (lighthouse, 89-011). SUMMER (Freckmann 13218).
- P. arguta* Pursh, prairie cinquefoil. Rare, collected only by Fuller (1618) in 1926, presumably from Jackson Harbor Ridges. Not noted since.
- P. norvegica* L., rough cinquefoil. Common weedy species. SNAKE (rare). CANA (occasional). CHAMBERS (Ugent 1240). SPIDER (Fewless 3178). PLUM (13324). DETROIT (13524). PILOT (occasional). WASHINGTON (Fuller 1363). HOG (occasional). ROCK (13095). GRAVELLY (89-154). POVERTY (Cranbrook Institute-Oakland University sight record). SUMMER (Tessene 37).
- **P. recta* L., rough-fruited cinquefoil. Uncommon, old fields and pastures. CHAMBERS (13990). PLUM (13293). DETROIT (13488). WASHINGTON (Schutz 11, UWGB). ROCK (Threlfall s.n., UWGB).
- P. simplex* Michx., old-field cinquefoil. Uncommon weedy species. ST. MARTIN (90-567).
- Prunus pensylvanica* L.f., fire or pin cherry. Fairly common, old fields, woodlands. GREEN (13245). CHAMBERS (13902). PLUM (13428). WASHINGTON (Fuller 1373). ROCK (13667). ST. MARTIN (90-561). POVERTY (Cranbrook Institute-Oakland University sight record). SUMMER (89-245).

- P. pumila* L., sand cherry. Local on dunes. CHAMBERS (13756). PLUM (13279). WASHINGTON (Fuller 1518).
- P. serotina* Ehrh., black cherry. Occasional rich upland forest tree. GREEN (rare). CHAMBERS (13743). ADVENTURE (rare). WASHINGTON (Fuller 1386). ROCK (13102). SUMMER (Freckmann 13221).
- P. virginiana* L., chokecherry. Common upland shrub; often abundant on bird islands. SNAKE (abundant). GREEN (13272). CANA (common). HAT (uncommon). CHAMBERS (Ugent 1245). ADVENTURE (common). LITTLE STRAWBERRY (fairly common). JACK (uncommon). HORSESHOE (fairly common). PLUM (13343). DETROIT (13452). PILOT (fairly common). WASHINGTON (Fuller 1372). HOG (fairly common). ROCK (13152). ST. MARTIN (89-013). LITTLE GULL (90-612). GULL (Cranbrook Institute-Oakland University sight record). POVERTY (89-232). SUMMER (Voss 13398). LITTLE SUMMER (fairly common).
- Rosa acicularis* Lindl. subsp. *sayi* (Schwein.) W.H. Lewis, prickly rose. Fairly common in many habitats including alkaline rockshores; also on bird islands. ADVENTURE (uncommon). SPIDER (1905 collection, MIL). WASHINGTON (13024). LITTLE GULL (89-164). GULL (89-179). POVERTY (90-253). SUMMER (90-636).
- **R. arkansana* Porter var. *suffulta* (Greene) Cockerell, Arkansas rose. Rare escape. ROCK (Cochrane 5195).
- R. blanda* Aiton, smooth rose. Occasional. GREEN (13265). PLUM (13372). WASHINGTON (Fuller 1560). ST. MARTIN (89-038).
- R. eglanteria* L., eglantine. Occasional weed. PLUM (several large shrubs, range light clearing, 1999). WASHINGTON (Fuller 1531). POVERTY (90-219). SUMMER (Freckmann 13217). ROCK (common near sand spit in 1999). LITTLE SUMMER (occasional).
- **R. multiflora* Murray, multiflora rose. Rare weed on Chambers Island (Ugent 1257).
- Rosa palustris* L., swamp rose. Noted only on Snake Island.
- Rubus allegheniensis* L.H. Bailey, Allegheny blackberry. Occasional. WASHINGTON (Pohl 30, MIL). ROCK (uncommon).
- R. frondosus* Bigelow, Yankee blackberry. Rare. DETROIT (13600).
- R. idaeus* L. var. *strigosus* (Michx.) Maxim., red raspberry. Fig. 55. Common, often on shores, bird islands, or increasing in heavily cut or deer-browsed woods. SNAKE (common). GREEN (13221). CANA (common). CHAMBERS (Ugent 1259). ADVENTURE (common). LITTLE STRAWBERRY (occasional). JACK (uncommon). SPIDER (1 July 1905 collection, MIL). PLUM (13326). DETROIT (common). PILOT (fairly common). WASHINGTON (Fuller 1389). HOG (fairly common). ROCK (13831). ST. MARTIN (89-090). LITTLE GULL (Cranbrook Institute-Oakland University sight record). GULL (Cranbrook Institute-Oakland University sight record). POVERTY (occasional). SUMMER (fairly common). LITTLE SUMMER (Freckmann 13142).
- R. occidentalis* L., black raspberry. Occasional. CHAMBERS (Ugent 1258). WASHINGTON (Fuller 1462). LITTLE GULL (89-162). SUMMER (Cranbrook Institute-Oakland University sight record).
- R. parviflorus* Nutt., thimbleberry. Locally common in thickets near coasts, especially on the edges of boreal forests and stabilized dunes. It is interesting that this species is declining on the outer islands of three northern Great Lakes islands archipelagoes. On Outer Island, the remotest of the Apostles Islands, Wisconsin, it was noted in 1978 but was gone by 1990 (Judziewicz & Koch 1993); on Passage Island, the remotest island of the Isle Royale archipelago, Michigan, it was present in 1984 but gone by 1994 (Judziewicz 1999), and on Rock Island, remotest of the Grand Traverse islands, it was present in 1972 but gone by 1997. CANA (occasional). SPIDER (1905 collection, MIL). DETROIT (occasional). WASHINGTON (Fuller 1395). ROCK (sight record by G.J. Knudson in 1964; Cochrane 5184 in 1972 as a "12 x 15 yard colony"; but not noted in 1997-1999). ST. MARTIN (89-015). SUMMER (Voss 13382; occasional in 1998).
- R. pubescens* Raf., dwarf red raspberry. Occasional, cedar swamps. DETROIT (13478). WASHINGTON (Goessl 3972). SUMMER (Tessene 118).
- **Sorbus aucuparia* L., European mountain-ash. Rare escape from cultivation. WASHINGTON (Rose 61, UWGB).

S. decora (Sarg.) C.K. Schneid., showy mountain-ash. Widespread (but not common) tree, mostly in coniferous areas near coasts. CANA (occasional). ADVENTURE (rare). PLUM (13310). DETROIT (13448). WASHINGTON (*Fuller 1535*). ROCK (*Tans 816*). ST. MARTIN (89-023). GULL (89-172). POVERTY (occasional). SUMMER (*Voss 13392*). LITTLE SUMMER (uncommon).

Spiraea alba Du Roi, meadowsweet. Uncommon, wetlands. CHAMBERS (*Ugent 1242*). WASHINGTON (Coffee Swamp, 13077).

RUBIACEAE (Bedstraw Family)

G. aparine L., cleavers. Locally common in deciduous woods, perhaps increasing because of deer dispersal. SNAKE (occasional). GREEN (13215). CHAMBERS (12705). HORSESHOE (rare). PLUM (12671). DETROIT (12658). WASHINGTON (*Cochrane 11080*). SUMMER (*Voss 13369*). LITTLE SUMMER (12971).

G. brevipes Fernald & Wiegand, limestone swamp bedstraw. Rare; Summer Island. On overturned *Fraxinus* in dried [woodland] pond, Sec. 28, *Tessene 65*.

G. lanceolatum Torr., wild licorice. Uncommon, rich upland hardwoods. CHAMBERS (12710). WASHINGTON (*Fuller 1612*; Island Campground woods, 14018). ROCK (12511).

G. tinctorium L., stiff bedstraw. Uncommon, wetlands. CHAMBERS (*Fassett s.n.*, 15 June 1935, WIS). WASHINGTON (13604).

G. trifidum L., small bedstraw. Uncommon, wetlands. WASHINGTON (*Fewless & Moore 5950*). GULL (*Cranbrook Institute-Oakland University sight record*). SUMMER (90-674).

G. triflorum Michx., sweet-scented bedstraw. Common, woods. SNAKE (uncommon). GREEN (13237). CANA (uncommon). CHAMBERS (*Ugent 1119*). ADVENTURE (uncommon). HORSESHOE (rare). PLUM (13398). DETROIT (13597). WASHINGTON (*Fuller 1473*). ROCK (13168). ST. MARTIN (89-060). LITTLE GULL (*Cranbrook Institute-Oakland University sight record*). POVERTY (89-227). SUMMER (90-665). LITTLE SUMMER (fairly common).

Houstonia longifolia Gaertn., long-leaved bluets. Local on alvar and alkaline rockshores, only on the Michigan islands. POVERTY (12819). SUMMER (90-680c). LITTLE SUMMER (12926).

Mitchella repens L., partridgeberry. Occasional, woods, mostly coniferous ones. CHAMBERS (12707). WASHINGTON (*Goessl 3958*). ROCK (12549). SUMMER (*Tessene 123*).

SALICACEAE (Willow Family)

**Populus alba* L., white poplar. Rare escape. WASHINGTON (uncommon). ST. MARTIN (interior, 90-589).

P. balsamifera L., balsam-poplar. Occasional tree; often on shores. SNAKE (fairly common). CHAMBERS (*Ugent 1048*). PLUM (13287). DETROIT (13438). PILOT (S. P. Voice 1982 sight record). WASHINGTON (*Fuller 1499*). ROCK (13668). ST. MARTIN (*Cranbrook Institute-Oakland University sight record*). LITTLE GULL (*Cranbrook Institute-Oakland University sight record*). POVERTY (*Cranbrook Institute-Oakland University sight record*). SUMMER (*Tessene 135*). LITTLE SUMMER (occasional).

P. deltoides L. subsp. *monilifera* (Aiton) Eckenw., plains cottonwood. Fig. 55. Occasional tree, most often of sheltered bays on Lake Michigan; also bird islands. HAT (dead trees in 1998). CHAMBERS (13911). ADVENTURE (rare). JACK (dead trees in 1998). DETROIT (13437). WASHINGTON (*Fewless 6934*). ROCK (13689). ST. MARTIN (*Cranbrook Institute-Oakland University sight record*). LITTLE GULL (*Cranbrook Institute-Oakland University sight record*). SUMMER (*Cranbrook Institute-Oakland University sight record*).

P. grandidentata Michx., big-toothed aspen. Occasional second-growth upland forest tree. CHAMBERS (*Ugent 1055*). WASHINGTON (*Fuller 1400*). ROCK (13123). SUMMER (*Freckmann sight record, 1976*).

P. tremuloides Michx., quaking aspen. Common second-growth forest tree. SNAKE (occasional). GREEN (13212). CANA (uncommon). CHAMBERS (12756). ADVENTURE (occasional). LITTLE STRAWBERRY (rare). HORSESHOE (uncommon). PLUM



FIGURE 55. Hat Island, a two acre bird island in Green Bay several miles south of Chambers Island. To the right, Joel A. Trick of the U.S. Fish and Wildlife Service fends off gulls under a dead cottonwood (*Populus deltoides* subsp. *monilifera*). In the left foreground is bush of American black currant (*Ribes americanum*), 6 May 1998.

- (14093). DETROIT (13445). PILOT (uncommon). WASHINGTON (Fuller 1402). HOG (uncommon). ROCK (13113). LITTLE GULL (Cranbrook Institute-Oakland University sight record). GULL (89-176). POVERTY (Cranbrook Institute-Oakland University sight record). SUMMER (Voss 13396). LITTLE SUMMER (fairly common).
- Salix amygdaloides* Andersson, peached-leaved willow. Occasional shoreline tree. CHAMBERS (Ugent 1061). PLUM (13381). ROCK (13830). ST. MARTIN (Cranbrook Institute-Oakland University sight record).
- S. bebbiana* Sarg., beaked willow. Common small tree of wetlands and shores. CANA (uncommon). CHAMBERS (Ugent 1062). PLUM (13382). DETROIT (13433). WASHINGTON (Fewless 5173). ROCK (12530). POVERTY (90-258). SUMMER (Voss 12623).
- S. candida* Flugge, hoary willow. Local, boreal fens and calcareous swamps. CANA (rare). DETROIT (12778). WASHINGTON (Coffee Swamp and Big Marsh, Fuller 1445).
- S. cordata* Michx., dune willow. ENDANGERED (WI). This Great Lakes dunes willow has recently discovered at Jackson Harbor Ridges, Washington Island by Gary Fewless (collection at UWGB). Also possibly 13696 (identification needs to be verified).
- S. discolor* Muhl., pussy willow. Common small tree of wetlands. SNAKE (occasional). GREEN (13202). CANA (uncommon). SPIDER (1905 collection, MIL). DETROIT (13433). PILOT (rare). WASHINGTON (Fewless 5556). POVERTY (89-226).
- S. eriocephala* Michx., diamond willow. Local, dunes and rockshores. WASHINGTON (Jackson Harbor Ridges, Fewless 5174). POVERTY (89-259). SUMMER (90-638).
- S. exigua* Nutt. subsp. *interior* (Rowlee) Cronquist, sandbar willow. Occasional, sheltered sandy shores along Lake Michigan. SNAKE (occasional). CANA (uncommon). LITTLE STRAWBERRY (uncommon). CHAMBERS (Ugent 1060). PLUM (14084). DETROIT (13449). WASHINGTON (Fewless 5525). ROCK (12537). POVERTY (89-210). SUMMER (Tessene 150).

- S. lucida* Muhl., shining willow. Occasional tree of shorelines. SNAKE (occasional). GREEN (13198). CANA (uncommon). SPIDER (1905 collection, MIL). WASHINGTON (*Fewless* 5524). ROCK (12538). SUMMER (*Voss* 12622).
- S. myricoides* Muhl., bayberry willow. Rare. POVERTY (90-264).
- S. pedicellaris* Pursh, bog willow. Rare, known only from Little Lake fen, Washington Island (*Fuller* 1441).
- S. petiolaris* Sm., slender willow. Uncommon shrub or small tree of wetlands. ROCK (13688). ST. MARTIN (90-301). POVERTY (90-255).

SANTALACEAE (Sandalwood Family)

- Comandra umbellata* (L.) Nutt., bastard-toadflax. Fairly common, dunes and cedar-fir thickets. SNAKE (rare). CHAMBERS (*Ugent* 1000). PLUM (13370). DETROIT (13552). WASHINGTON (*Goessl* 3945). ROCK (*Cochrane* 5202). ST. MARTIN (90-575). POVERTY (12814). SUMMER (*Voss* 13403). LITTLE SUMMER (12922).
- Geocaulon lividum* (Richardson) Fernald, northern comandra. ENDANGERED (WI). Found only in conifer forests (cedar, fir) at Jackson Harbor Ridges, Washington Island (*Fewless* 5567).

SARRACENIACEAE (Pitcher-Plant Family)

- Sarracenia purpurea* L., pitcher-plant. Rare, acid sphagnum patches under cedars in Coffee Swamp, Washington Island (13069).

SAXIFRAGACEAE (Saxifrage Family)

- Mitella diphylla* L., bishop's-cap. Uncommon in rich upland hardwoods. WASHINGTON (12647). ROCK (13118). ST. MARTIN (*Fuller* 1633).
- M. nuda* L., naked mitrewort. Occasional, swamp (mainly conifer) forests. CHAMBERS (13964). DETROIT (13464). WASHINGTON (*Goessl* 3976). SUMMER (*Voss* 12362). LITTLE SUMMER (common).
- Parnassia parviflora* DC., small-flowered grass-of-parnassus. ENDANGERED (WI), no status (MI). In the GTA, it is known only from a 26 July 1913 collection from Detroit Harbor, Washington Island (*Davis s.n.*, WIS) and from 1926 collection from St. Martin Island (*Fuller* 1631), Michigan. It was not seen in 1998-1999, and may be extirpated in Wisconsin (James Meeker, pers. comm.).

SCROPHULARIACEAE (Figwort Family)

- Agalinis purpurea* (L.) Pennell, purple false foxglove. Fairly common and characteristic of wet alkaline shores. PLUM (Carp Lake meadow, 14072). DETROIT (uncommon, south tip). WASHINGTON (*Fewless & Moore* 5911). ROCK (12489). SUMMER (*Tessene* 158).
- Castilleja coccinea* (L.) Spreng., Indian paintbrush. Fairly common, gravelly calcareous old fields and pastures, and alkaline rockshores. ADVENTURE (*Bruncken s.n.*, 11 July 1905, MIL). SPIDER (1 July 1905 collection, MIL). DETROIT (12779). WASHINGTON (*Fuller* 1569). ROCK (13690). ST. MARTIN (90-582). POVERTY (89-219). SUMMER (12606). LITTLE SUMMER (12918).
- **Linaria spartea* (L.) Chaz. Rare weed in dolomite gravel of lane on Little Summer Island in 1998 (12972). The only other Michigan or Wisconsin site for this slender plant with pale blue, yellow-paletted flowers is from Menominee County, Michigan across Green Bay, where it was collected in a vacant lot by Don Henson in 1984 (*Voss* 1996).
- **L. vulgaris* Mill., butter-and-eggs. Occasional weed. CANA (occasional). PLUM (13286). DETROIT (13888). WASHINGTON (*Fuller* 1587).
- Melampyrum lineare* Desr., cow-wheat. Occasional in conifer forests, most often on dolomite bluffs under white cedars. CHAMBERS (13730). PLUM (13401). DETROIT (13503). WASHINGTON (*Fuller* 1571). ROCK (*Cochrane* 5201). POVERTY (*Cranbrook Institute-Oakland University* sight record). SUMMER (*Tessene* 25).
- Mimulus ringens* L., monkey-flower. Noted only from wetlands on Snake Island, where it is occasional.
- Pedicularis canadensis* L., wood-betony. Rare, known only from mixed hardwood-conifers on stabilized dunes on Rock Island (12643).

Scrophularia lanceolata Pursh, early figwort. Occasional, clearings, fields, bird islands. SNAKE (rare). GREEN (13216). CANA (uncommon). ADVENTURE (rare). LITTLE STRAWBERRY (rare). JACK (occasional). DETROIT (uncommon). WASHINGTON (Goessl 3928). POVERTY (89-222). SUMMER (90-730).

**Verbascum thapsus* L., common mullein. Common weed; fields, disturbed dolomite cliffs. SNAKE (uncommon). GREEN (occasional). CANA (occasional). CHAMBERS (*Ugent* 1114). PLUM (14089). DETROIT (fairly common). PILOT (occasional). WASHINGTON (Fuller 1360). ROCK (13812). ST. MARTIN (89-008). LITTLE GULL (*Cranbrook Institute-Oakland University sight record*). POVERTY (90-237). SUMMER (*Tessene* 143). LITTLE SUMMER (fairly common).

**Veronica anagallis-aquatica* L., water-speedwell. Common Lake Michigan shoreline weed. CANA (occasional). HAT (rare). PLUM (13389). DETROIT (13561). WASHINGTON (Fewless & Moore 5930). POVERTY (89-212). SUMMER (90-675). LITTLE SUMMER (12974).

**V. arvensis* L., corn speedwell. Widespread but nondescript weed. CANA (rare). CHAMBERS (12703). ADVENTURE (rare). HORSESHOE (rare). PLUM (12673). DETROIT (12792). WASHINGTON (13010). ROCK (*Cochrane* 5232). SUMMER (12909). LITTLE SUMMER (12941).

**V. beccabunga* L., European speedwell. Uncommon, wetlands. WASHINGTON (*Schutz* 130, UWGB). SUMMER (90-755). LITTLE SUMMER (12936).

**V. longifolia* L., long-leaved speedwell. Rare escape from cultivation. WASHINGTON (*Threlfall s.n.*, UWGB).

**V. officinalis* L., common speedwell. Occasional weed of woods, often in dense shade. CANA (rare). HORSESHOE (rare). PLUM (12688). DETROIT (13584). WASHINGTON (Fuller 1482). ROCK (*Cochrane* 5229). ST. MARTIN (89-122).

V. peregrina L., purslane speedwell. Rare weed. WASHINGTON (13632).

**V. serpyllifolia* L., thyme-leaved speedwell. Uncommon weed, typically along shaded muddy paths, forest lanes, and lawns. WASHINGTON (*Goessl* 3950). ROCK (13117). POVERTY (90-273). SUMMER (90-700).

SMILACACEAE (Catbrier Family)

Smilax ecirrhata (Kunth) S. Watson, upright carrion-flower. Occasional in sandy pine and oak woods on northern Chambers Island (13734). Also seen on Snake Island, where uncommon.

SOLANACEAE (Nightshade Family)

Physalis heterophylla Nees, clammy ground-cherry. Occasional weedy species of fields, pastures, and dunes. CHAMBERS (*Ugent* 1110). DETROIT (13442). WASHINGTON (Fuller 1500). ROCK (12546).

**Solanum dulcamara* L., bittersweet nightshade. Occasional weed of wetland edges; can be frequent on bird islands. SNAKE (occasional). GREEN (13268). CANA (uncommon). HAT (uncommon). CHAMBERS (*Ugent* 1113). LITTLE STRAWBERRY (occasional). JACK (occasional). SISTER (common in 1970). PLUM (13388). DETROIT (13461). PILOT (occasional). WASHINGTON (13793). HOG (occasional). ROCK (13681). POVERTY (89-281). SUMMER (*Tessene* 113). LITTLE SUMMER (occasional).

S. ptycanthum Dunal, black nightshade. Occasional weed, often on bird islands. SNAKE (rare). CHAMBERS (*Ugent* 1111). DETROIT (13890). LITTLE GULL (89-165). GULL (*Cranbrook Institute-Oakland University sight record*). POVERTY (*Cranbrook Institute-Oakland University sight record*).

SPARGANIACEAE (Bur-Reed Family)

Sparganium emersum Rehmann, narrow-leaved bur-reed. Uncommon aquatic. CHAMBERS (Lake Mackaysee, 13955). WASHINGTON (*Rose* 285, UWGB).

S. eurycarpum A. Gray, giant bur-reed. Uncommon aquatic. WASHINGTON (*Rose* 286, UWGB).



FIGURE 56. Little Strawberry Island, an eight acre island between Chambers Island and the Door Peninsula that is being invaded by colonial waterbirds (gulls and Double-crested Cormorants). The forest is nearly pure basswood (*Tilia americana*) growing on dolomite cobbles. Cow-parsnip (*Heracleum lanatum*) is dominant in the understory. Here, the island's caretaker "reloads" an acetylene cannon used in an attempt to scare off the birds, 6 May 1998.

THYMELAEACEAE (Mezereum Family)

Dirca palustris L., leatherwood. Rare shrub of rich upland woods on Washington Island (Fuller 1534). In 1998, only one plant was noted only on the Mountain Tower outcrop (12767).

TILIACEAE (Basswood Family)

Tilia americana L., basswood. Fairly common, rich upland woods. Fig. 56. SNAKE (abundant, co-dominant with white cedar). GREEN (13243). CHAMBERS (Ugent 1221). ADVENTURE (common). LITTLE STRAWBERRY (abundant). JACK (rare). HORSESHOE (fairly common). PLUM (13416). DETROIT (13447). WASHINGTON (Fuller 1533). ROCK (13156). ST. MARTIN (89-118). SUMMER (Voss 13367).

TYPHACEAE (Cat-tail Family)

Typha latifolia L., common cat-tail. Locally common aquatic. SNAKE (occasional). CHAMBERS (Lake Mackaysee, 13926). WASHINGTON (uncommon, Coffee Swamp).

**T. X glauca* Godron, hybrid cat-tail. Rare; wet borrow pit near Viking Hall on Rock Island (13646).

ULMACEAE (Elm Family)

Ulmus americana L., American elm. Uncommon tree, most now killed by disease. CHAMBERS (13900). WASHINGTON (Fuller 1532). ROCK (13820).

URTICACEAE (Nettle Family)

Parietaria pensylvanica Willd., pellitory. SNAKE (fairly common). CHAMBERS (rare, shaded woods, Ugent 1002). ROCK (locally common on sunny dolomite scree of abandoned quarry, 12513).

Pilea pumila (L.) A. Gray, clearweed. Uncommon, wet edges and shores. SNAKE (uncommon). CHAMBERS (13950). DETROIT (13591).

Urtica dioica L. subsp. *gracilis* (Aiton) Selander, stinging nettle. Common in swamps and on bird islands. SNAKE (abundant). GREEN (13227). HAT (fairly common). CHAMBERS (13719). ADVENTURE (uncommon). LITTLE STRAWBERRY (occasional). JACK (occasional). SISTER (common in 1970). PLUM (13325). DETROIT (13887). PILOT (occasional). WASHINGTON (*Fewless & Moore* 5922). HOG (occasional). ROCK (13825). GRAVELLY (89-152). GULL (*Cranbrook Institute-Oakland University sight record*). POVERTY (*Cranbrook Institute-Oakland University sight record*). SUMMER (*Tessene* 130). LITTLE SUMMER (fairly common).

VALERIANACEAE (Valerian Family)

**Valeriana officinalis* L., garden valerian. Rare weed on Plum Island in range light clearing (13336).

VERBENACEAE (Vervain Family)

Phryma leptostachya L., lopseed. Occasional in rich upland woods, but not on the Michigan Islands. SNAKE (occasional). CHAMBERS (13727). DETROIT (13840). WASHINGTON (13806). ROCK (*Threlfall s.n.*, UWGB).

Verbena hastata L., blue vervain. Uncommon, swamps and marshes. SNAKE (fairly common). CHAMBERS (*Ugent* 1184). WASHINGTON (*Fuller* 1593). ROCK (13821).

VIOLACEAE (Violet Family)

Viola adunca Sm., hook-spur violet. Occasional, dry fields, cedar-fir thickets, and alkaline rockshores. CHAMBERS (12724). PLUM (12677). DETROIT (uncommon near dock). WASHINGTON (*Goessl* 3981). ROCK (12597). POVERTY (12832). SUMMER (*Voss* 12625; in lawn of pine-shaded cabin in Summer Harbor, 1998).

V. blanda Willd., sweet white violet. Rare, Poverty Island (12835).

V. canadensis L., Canada white violet. Locally frequent in rich upland hardwoods. PLUM (12669). WASHINGTON (*Fuller* 1602). ROCK (12624). LITTLE SUMMER (12954).

V. labradorica Schrank, dog violet. Common, woods and fields. SNAKE (rare). CHAMBERS (12713). ADVENTURE (uncommon). LITTLE STRAWBERRY (rare). PLUM (12675, 13317). DETROIT (12669). WASHINGTON (12649). ROCK (13108). SUMMER (*Voss* 12609). LITTLE SUMMER (12931).

V. macloskeyi F.E. Lloyd subsp. *pallens* (Ging.) M.S. Baker, small white violet. Occasional, often in cedar-fir thickets and coniferous swamps. WASHINGTON (*Goessl* 3978). ROCK (12610). POVERTY (12839). SUMMER (12874).

V. nephrophylla Greene, northern bog violet. This is the common deep blue "alvar" violet of Great Lakes alkaline rockshores. DETROIT (12661). WASHINGTON (*Goessl* 3989). POVERTY (89-224). SUMMER (*Voss* 12618).

V. pubescens Aiton, yellow violet. Common, woods. GREEN (13230). CHAMBERS (*Ugent* 1194). PLUM (12670). DETROIT (uncommon, central hill). WASHINGTON (*Fuller* 1384). ROCK (12619). ST. MARTIN (89-052). SUMMER (*Voss* 12640). LITTLE SUMMER (12970).

V. renifolia A. Gray, kidney-leaved violet. Uncommon, woods. CHAMBERS (12715). WASHINGTON (*Fuller* 1489). SUMMER (*Voss* 12602).

V. rostrata Pursh, long-spurred violet. SPECIAL CONCERN (WI). This violet of beech-sugar maple woods in known only from Washington Island, where it was collected from an unspecified locality in 1916 (*Bruncken s.n.*, 6 June 1916, MIL). It was recorded in 1998 from a mesic forest east of Coffee Swamp.

V. selkirkii Goldie, Selkirk's violet. Rare, woods. ROCK (12644).

V. sororia Willd., common blue violet. Rare, woods. SNAKE (common). POVERTY (90-277).

VISCACEAE (Christmas-Mistletoe Family)

Arceuthobium pusillum Peck, eastern dwarf mistletoe. Rare, parasitic on black spruce at Jackson Harbor Ridges, Washington Island (*Fewless* 5163).

VITACEAE (Grape Family)

Parthenocissus vitacea (Knerr) Hitchc., grape woodbine. Local woody climber of shores. SNAKE (occasional). GREEN (13273). LITTLE STRAWBERRY (uncommon).

Vitis riparia Michx., riverbank grape. Occasional, shores and bird islands. SNAKE (uncommon). GREEN (13274). CHAMBERS (*Ugent* 1220). JACK (occasional). HORSESHOE (uncommon). DETROIT (rare). WASHINGTON (Little Marsh and Big Marsh, 13794). ROCK (13111). ST. MARTIN (near pond, 90-320). SUMMER (*Tessene* 149).

**V. vulpina* L., fox grape. Escaped from cultivation in the 1930s. WASHINGTON (*Pohl* 32, MIL).

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On the Cover: *West coast of Pilot Island, Wisconsin, which was invaded by colonial waterbirds in the 1980s and 1990s. The dead white cedar forest overtops a dense shrub layer of red-berried elder and red-osier dogwood. Photo by the author, 22 July 1999.*